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Disposition of Tuberculosis in Industrial Organizations

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Industrial Hygiene in the High School of Commerce

The Housing Problem in Great Britain and Ireland

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HEALTH HAZARDS IN THE PEARL BUTTON INDUSTRY*

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THE pearl button industry has always been considered as a dusty trade and consequently the tuberculosis incidence among the workers has been assumed to be high. There is, however, little definite data in the literature on the subject though the investigations which have been made seem to bear out this assumption. Thus, out of 390 deaths among the pearl button workers in Vienna between 1895 and 1905, 69.7 per cent. died from consumption, and Teleky in an examination of 150 pearl button workers in 1907 found that only ninety-three had normal lungs (1). Of 127 cases studied by one insurance company, forty-eight, or 37.8 per cent., died of pulmonary tuberculosis and fourteen, or 11 per cent. additional, died of other respiratory infections. Kober and Hanson are also authority for the statement that osteomyelitis, especially of the bones of the forearm and hand, occurs frequently among button workers. Dyspeptic conditions and catarrhal affections are also stated to be common.

The pearl button industry of the United States affords employment for about 5000 persons. About one-third of this number is employed in Iowa and the industry is worth about $5,000,000 annually to this state. One town alone employs about 1500 persons in the manufacture of pearl buttons, and it was consequently felt that a detailed survey of the industry in this town would be of value. The survey includes not only a study of the dust hazard but of all health hazards found to occur, together with an investigation of general living conditions, the type of workers, and any other hygienic considerations peculiar to this industry.

DESCRIPTION OF PROCESSES INVOLVED

The process of making pearl buttons involves more or less dust from start to finish. The shells are cleaned and then soaked in water for a considerable period of time to make them less brittle. The "blanks" are then cut from the shells. This process of cutting the blanks is a wet process. Jets of water playing on the saw cause a fine spray to fly continually from the saw, covering the objects in the near vicinity and flying in the face of the cutter. The blanks are then ground by being passed on a belt beneath an emery wheel making about 1000 revolutions per minute, the buttons thus being reduced to uniform thickness.

* Received for publication March 3, 1920.

† Deceased Feb. 4, 1920.

This process is dry and involves a large amount of dust which is partially controlled by means of suction apparatus. The blanks are then ready for the holes and patterns to be made on so-called automatic machines or chucks — a process involving the production of dust. Although in this case there is not so much dust produced as in the grinding process, it is more difficult to control. The buttons are next polished, usually by chemical processes, and then sorted and carded. This, in brief, covers the processes of pearl button manufacture.

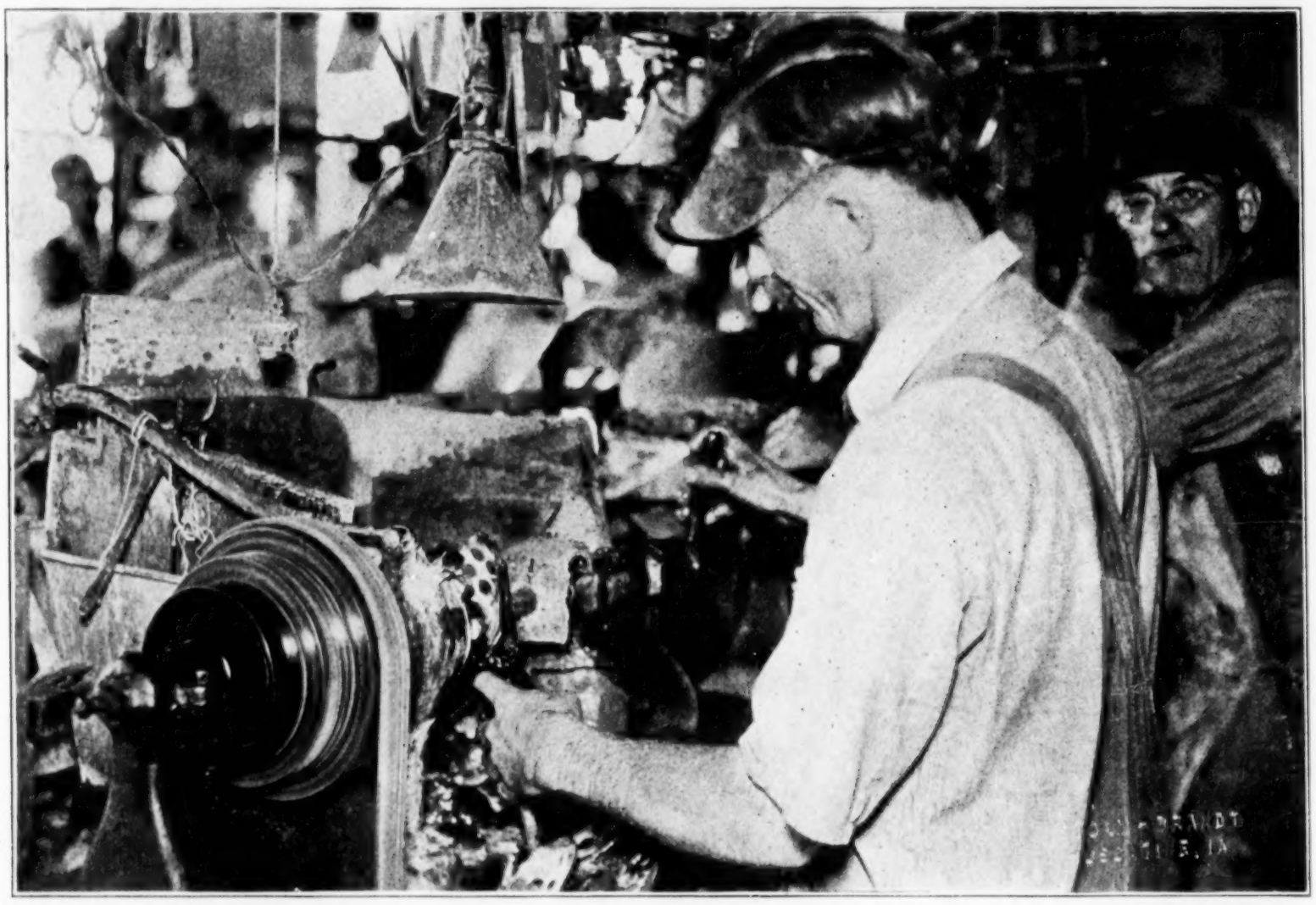

FIG. 1. — Cutting room, showing method of cutting the blanks from the shell. Note the dust dried on the lamp shade and on the worker's arm.

GENERAL HYGIENIC AND SANITARY CONDITIONS

In the town surveyed there are eight or ten larger factories employing from 100 to 300 people — factories which include all stages of the processes of button making. In addition, there is a considerable number of plants of smaller size which, however, only cut blanks. The problem is more or less complicated by the shifting character of the workers, few of them working very long at a time in any one factory. Furthermore, many work only during the fall and winter months, leaving the factory in the summer to spend their time digging clams. Such open-air work during a part of the year undoubtedly has a beneficial effect in counteracting any deleterious influences connected with the inside work in the factory. The work is all piece-work, the employees being paid by the quantity they produce instead of a definite sum per hour. In view of this, the problem of fatigue enters into consideration.

The general hygienic and sanitary conditions in the larger factories are, on the whole, fair. The dust elimination is fairly well controlled and the larger manufacturers always look for better methods of dust elimination. In six plants the ventilation is only fair; in two plants, ventilation is obtained by means of large fans and by suctions, and the conditions in this respect

are excellent. None of the plants have ideal toilet facilities, although in only one of the larger plants are the toilet facilities inadequate. No provision is made for sick benefit. The work being, as stated, all piece-work the employees are more or less free to work as they see fit, and in five of the plants studied no effort was made to determine the cause of absence from work.

The hygienic construction is good in four of the plants, and bad in the other four, many of the rooms being poorly lighted and poorly ventilated. Viewed from a hygienic and sanitary standpoint, the conditions in the cutting rooms are always the poorest of any of the processes (Fig. 1). The rooms are usually damp, dirty and dark. The streams of water which trickle over the saws, keeping them cool and helping to eliminate the dust, run down the edges of the benches into a trough. This trough is usually used as a cuspidor except where the cutters spit upon the floor. There is usually more or less water on the floor and the cutters work constantly with their hands in cold water. This seems to have an effect in lowering the resistance to infection, organisms being carried mainly by the organic material on the shells and entering the skin through small cuts and abrasions. One plant soaks the shells in an antiseptic solution and reports a very low incidence of infections of this character. While the water playing over the saws is intended to eliminate dust, the fine spray produced in cutting the shells flies through the air almost as freely as dry dust. This spray is laden with shell dust and the cutters are constantly inhaling the spray.

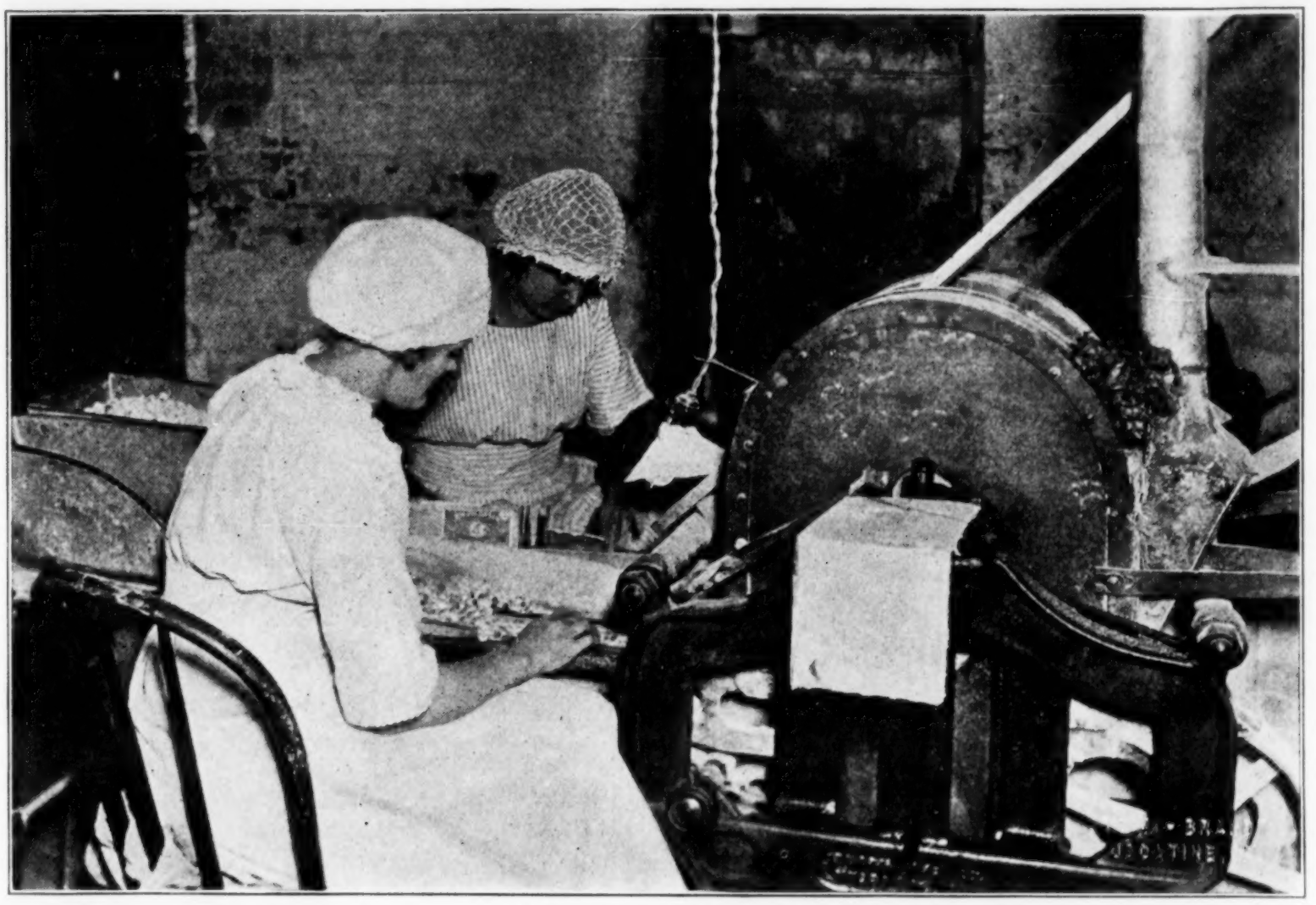

FIG. 2. — Grinding room, showing the process of grinding button blanks to uniform thickness.

In the grinding rooms, women are employed to a large extent. Their work is to place the blanks on a belt passing under an emery wheel which grinds down the blanks to uniform thickness. The emery wheel itself is incased in a hood from which the air is exhausted by means of suction, carrying away a large portion of the dust. There is another suction device beyond the emery wheel which sucks the buttons off the belt, together with a considerable proportion of

the dust (Fig. 2). All the dust, however, is not removed. The grinders' hands are always covered with the fine shell dust and all the objects in the room are laden with it.

In the automatic room the holes are bored in the buttons by the chuck and the desired patterns are cut. The dust elimination here is a complicated problem because the processes of boring and grinding take place at different points on the machine and all of the processes are productive of dust (Fig. 3). Here as in the grinding room the workers are mostly girls, and their hands are always covered with dust. Dust is observed on the machines and on all objects in the room. These rooms are usually ventilated by fans which exhaust the air. Dust is exhausted from the machine through pipes usually into the open air above the roof of the factory, although one plant has installed a system of baffles which collect the dust and prevent it from escaping into the outside air.

In the polishing room there seems to be no special health hazard, although in one plant steam escaping into the room was sufficient to constitute a hazard. In the sorting room the main hazards are fatigue from the monotonous character of the work, and eye strain. There is no special dust problem involved here.

General cleanliness in the larger plants is, on the whole, good. The cutting rooms, however, with one exception, leave much to be desired. The smaller plants vary in size from one room employing two men up to establishments employing twenty or thirty men. These smaller plants cut blanks only, no grinding or polishing being done. The general hygienic and sanitary conditions in these smaller plants are universally poor. The toilet facilities are inadequate and the methods of eliminating the water used in the process are more or less haphazard. On the whole, the smaller plants compare unfavorably with larger ones.

Although there are on all the grinding machines and in the boring machines powerful suction devices, dust is the most important health hazard. The amount of dust produced is so enormous that it is difficult to devise any method which will eliminate it completely. Much dust sticks to the belts and is continually thrown off into the air of the rooms. The boring process is especially difficult to control and the boring machines are more or less covered with dust at all times. The general health of the employees is apparently good. The majority of them, however, are of a low standard of mentality and fail to appreciate or take advantage of any means employed to decrease the health hazards in connection with their work. Although in one or two of the plants washing facilities are adequate, yet in these as in all of the plants the hygienic and sanitary principles practiced are far from ideal and much dust is probably ingested and inhaled from the hands of the workers.

Catarrhal conditions are common and the workers take it practically as a matter of course that persons engaged in this industry are more or less universally subject to catarrh.

General Considerations Regarding the Dust Hazard

It will be seen from Figure 2 that the hoods and suction devices employed in the grinding are of faulty construction. Although the hood completely covers the wheel, the end of the belt is left open and much dust is thrown off from it as the belt passes over the pulley. Much more dust could undoubtedly be eliminated by having the end of the belt as well as the emery wheel completely covered, instead of the present device by which the buttons are sucked from the belt through a narrow slotted opening which removes the dust inadequately.

In the cutting room, the water used is supposed to remove completely all dust, and dust is not considered by the manufacturers to be a hazard in this part of the work. As will be seen later, however, in the analyses of the air for dust, the water plays a very small part in the elimination of dust in this process, the dust being present in the air in the cutting room in the same amounts as in the grinding room. Jets of water which play over the saw are thrown into a fine spray as the shell is cut. This spray is heavily laden with dust as can be seen from the dried dust on the electric light shades and other objects in the room. Furthermore, this spray is inhaled and is so fine that it dries in the air, giving rise to an excessive dust content.

In the automatic room the control of the dust is a difficult problem owing to the various steps in the process which take place at different points, all involving the production of dust. The method of dust removal at present in use consists of a suction pipe which runs down close to the chuck where most of the dust is produced, a considerable portion of the dust being removed in this way.

FIG. 3. — Automatic room, where holes are drilled and patterns ground on the buttons. Note that each chuck has a suction pipe placed near it to remove dust.

DUST ANALYSES

In order to determine how much dust was present in the different rooms, analyses were made of the air. The method used was the Palmer water-spray apparatus (2) (3) (4), 100 cubic feet of air being passed through the apparatus for each analysis at the rate of about 4 cubic feet per minute. Table 1 shows the amount of dust per 100 cubic feet in the various rooms of the factory. It will be seen from this table that equally as much dust was found in the cutting room as in the grinding room in spite of the fact that in the former the wet process is used, whereas in the grinding room the process is dry. A further point brought out by these analyses is the fact that, although apparently from observation of the

process dust is produced in greater quantities in the grinding rooms than in the automatic rooms, the converse is true. This is undoubtedly due to the fact that less efficient means are used in the automatic room for the elimination of the dust. As shown by the analyses of the air, dust is not a hazard in the sorting room, the amount of dust in the air being no greater than the normal quantity.

TABLE 1.—AIR ANALYSES FOR DUST

Place	Mg. of Dust per 100 Cu. Ft.	
	A.M.	P.M.
Cutting Room	20.5	25.6
Grinding Room	26.0	31.4
Automatic Room	40.6	26.5
Sorting Room	..	2.0

No attempts were made to determine the size of the dust particles owing to the fact that in the sample of water they tend to clump together into large particles which are unsatisfactory for microscopic examination. The dust produced, however, is a very fine, impalpable powder. Owing to the fact that the collections were made at some distance from the laboratory, a considerable amount of time elapsed before the specimens could be examined. Microscopic examinations were thus rendered unsatisfactory. Table 1, consequently, gives only the total amount of dust in the air. The dust appears to be of a uniform size, all of the particles being very small.

Incidence of Tuberculosis

In order to ascertain the incidence of tuberculosis and other pathologic conditions of the lungs existing among the pearl button workers, a survey of the employees of several plants was made.* From the data obtained, it was found that the total incidence of tuberculosis in the community was 1.2 per cent.; the incidence among persons not employed in the pearl button industry was 1.02 per cent.; while the morbidity rate for tuberculosis among the pearl button workers themselves is shown by this report to be 2.6 per cent. Such statistics are open to criticism, and deductions from data so obtained are likely to be fallacious unless great care is taken in considering the factors which are involved. The figures for the amount of tuberculosis among the button workers are undoubtedly lower than is actually the case. It is an observed fact that dust, as a factor in the production of pulmonary tuberculosis, requires a period of years for its action — a fact which is brought out in Table 2. It was found that twenty-two out of thirty-three cutters examined were clinically tuberculous and only six out of the thirty-three gave negative lung examinations. All of these twenty-two cases, however, occurred among those who had worked at least five years at the cutting trade and all but two had worked ten years or longer. The figure 2.6 per cent., representing the incidence of infection among the button workers, includes all button workers, many of whom had been employed for less than a year — a period of time too short for the effect of the dust to be shown.

TABLE 2.—RESULTS OF PHYSICAL EXAMINATIONS OF CUTTERS

Length of Occupation	Number Examined	Positive Tuberculosis	Other Respiratory Disorders	Negative Respiratory Conditions	Rheumatism	Indigestion	Hand Infections
Under 1 year	0	0	0	0	0	0	0
1- 2 years	0	0	0	0	0	0	0
2- 5 "	1	0	0	1	0	0	0
5-10 "	3	2	0	1	1	1	1
10-15 "	12	8	4	3	3	2	1
15-25 "	11	6	1	1	3	3	0
Unknown	6	6	0	0	0	0	0
Total	33	22	5	6	7	6	2

* We are indebted for the physical examinations from which these conclusions are obtained to the kindness of Drs. W. W. Daut and E. M. Stiers. For other results embodied in this survey, we are indebted to the files of the Muscatine Welfare Board, through the kindness of Miss Woodward, the public health nurse of the boar d.

Table 4 shows eleven persons out of twenty-five examined who gave a history of the frequent occurrence of respiratory diseases other than tuberculosis. Such conditions as colds, catarrh and bronchitis,

TABLE 3. — RESULTS OF PHYSICAL EXAMINATIONS OF GRINDERS

Length of Occupation	Number Examined	Positive Tuberculosis	Other Respiratory Disorders	Negative Respiratory Conditions	Rheumatism	Indigestion
Under 1 year	1	0	0	1	0	1
1- 2 years	2	1	1	0	0	1
2- 5 "	6	4	2	0	2	4
5-10 "	1	0	0	1	0	0
10 "	1	1	0	0	0	1
Unknown	1	1	0	0	0	0
Total	12	7	3	2	2	7

many of which are undoubtedly incipient tuberculosis, undiagnosed, and which if not actually incipient tuberculosis lower the resistance to infection with tuberculosis, throw light on the mode of operation of the dust in rendering the lungs susceptible to this type of infection.

Table 5 shows a high incidence of tuberculosis and other respiratory diseases among the sorters where no dust hazard exists. All of these five sorters, however,

TABLE 4. — RESULTS OF PHYSICAL EXAMINATIONS OF AUTOMATIC MACHINE OPERATORS

Length of Occupation	Number Examined	Positive Tuberculosis	Other Respiratory Disorders	Negative Respiratory Conditions	Rheumatism	Indigestion
Under 1 year	5	0	2	3	0	0
1- 2 years	7	0	3	4	1	2
2- 5 "	6	0	3	3	2	3
5-10 "	6	0	2	4	3	2
10 "	1	0	1	0	0	0
Total	25	0	11	14	6	7

gave a family history of tuberculosis, it being very common for the father, brother or other relative to be employed in the cutting or grinding departments. In consequence, it is safer to assume that the home conditions were responsible for the high incidence among the sorters rather than the conditions under which they worked.

Other Health Hazards

In the examination of the button workers, rheumatism, indigestion, eye strain and other incidental health hazards were considered. It will be seen from the above tables that there seems to be a rather high incidence of rheumatism and indigestion, but it is doubtful if this incidence is higher than would be found in any other group of persons examined.

The number of hand infections among the cutters as shown by these examinations

TABLE 5. — RESULTS OF PHYSICAL EXAMINATIONS OF SORTERS

Length of Occupation	Number Examined	Positive Tuberculosis	Other Respiratory Disorders	Negative Respiratory Conditions	Rheumatism	Indigestion
1- 2 years	2	1	1	0	0	1
2- 5 "	2	1	1	0	0	0
5-10 "	1	1	0	0	0	0
Total	5	3	2	0	0	1

seems to be low, contrary to the general impression that such infections are rather common.

Among the sorters, eye strain is a common complaint due to the nature of the work. The buttons must be sorted rapidly into the different grades; this requires concentration and close attention. Furthermore, the postures observed seemed in many instances to promote undue fatigue.

Living Conditions

The influence of home conditions on disease production and general health and welfare of workers is well known. In this investigation the number of rooms per person and the method of sewage disposal, as may

be seen from Table 6, were taken as the two best criteria of satisfactory living conditions. The living conditions are, on the whole, above the average for this class of workers. Only 16 per cent. have less than one room per person and 62 per cent. have more than one room per person. Most of the workers live in individual houses, 76 per cent. of which have sewer connections, the other 24 per cent. having privies which are more or less sanitary, varying to a considerable degree in the individual cases.

Home Work

Most of the work of sewing the buttons on the cards preparatory to shipment and

TABLE 6.—HOUSING CONDITIONS OF FIFTY EMPLOYEES

Rooms per Person	Number of Employees	Per Cent. Employees
Less than 1	8	16
1	11	22
1-2	15	30
2	6	12
2-3	6	12
3	3	6
4	1	2
Total	50	100

sale is done at home, usually by members of the families of those employed in the factories. The objections that apply generally to home work, i. e., unhygienic surroundings, neglect of sanitary environment owing to time absorbed by work, low standards of living and spread of infection (5), apply to this work; but evidently to a less degree than usual. The homes visited were, on the whole, of the average type, viewed from a sanitary and hygienic point of view, and it is doubtful if the carded buttons constitute a significant factor in the spread of infection. In spite of these considerations, undoubtedly on general principles such work should be discouraged as much as possible.

General Discussion

The results obtained in this investigation seem to bear out the contention that dust is a serious health hazard in the pearl button industry. The cutters especially show a strikingly high incidence of tuberculosis. The dust does not show its effects in producing respiratory diseases, however, until a considerable period of time has elapsed. Death is due in an abnormal number of cases to tuberculosis but it does not occur early in life, usually operating about the prime of life or shortly thereafter, from forty-five to fifty-five years of age. Among the grinders and the automatic machine workers the relation of dust and the incidence of tuberculosis is also noticeable. It is not so clear cut, however, as among the cutters, since a large number of the workers in the grinding, automatic and sorting rooms give a family history of a father who was a cutter and developed tuberculosis. The home conditions, consequently, are undoubtedly factors in the excessive amount of tuberculosis among this class of workers.

There are a number of recommendations which can be made to improve the health of pearl button workers. In the first place, it is a fallacy that the use of water in the cutting room keeps down the dust. The amount of dust present in the air of the cutting rooms is as high as in the grinding and automatic rooms. Some method should be devised to prevent the dust-laden spray from flying into the workers' faces and being inhaled. Some efficient suction device should be employed in the cutting rooms, at least to the same extent as in the other departments where dust is produced. The amount of dust in the grinding rooms, however, indicates that a large part of grinding dust is removed. Although a great amount of dust is produced in this process, no more was found in the air of the grinding rooms than in the air of the cutting rooms. Much more dust could, however,

undoubtedly be removed by covering the end of the belt with a hood. A series of examinations showed more dust to be present in the automatic room than in either the cutting or grinding departments. This is due to the relative difficulty of removing the dust produced in this process. The dust, while not produced in the quantities that occur in the cutting and grinding rooms, is still in considerable amount and should be more effectually controlled. Throughout the factories it was observed that the workers' hands were covered with dust at all times, and undoubtedly ingestion plays an important part. Toilet and washing facilities and instructions to the workers in hygienic and sanitary principles would aid in the elimination of the dust hazard.

In most of the factories, especially in the larger plants, the ventilation is excellent. Lighting and other sanitary arrangements in general are very fair. The smaller plants, where only cutting of the blanks is done, are the places where the most unsanitary conditions were found. Most of these smaller establishments are dark, damp and unsanitary in every way, and means should be found by the community to control these smaller places.

Summary

Dust is a health hazard in the pearl button industry.

The amount of dust and the nature of its production make it difficult to control.

The incidence of tuberculosis among the employees is high but operates mainly after ten years' employment.

Further improvements not only in dust control but in general hygienic and sanitary equipment are recommended.

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DISPOSITION OF TUBERCULOSIS IN INDUSTRIAL ORGANIZATIONS*

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PULMONARY tuberculosis is the most difficult problem in industrial medicine, and one that is always present. This is because of its great frequency and its long duration, which often carries the case beyond the period of absence and amount of financial assistance usually allowed. The solution of the problem is further hampered by many underlying factors which have to be considered before the right course can be determined upon. Among these varying conditions are:

1. Personnel of organization: e. g.,
   a. Manual labor.
   b. Skilled labor.
   c. Clerical staff, etc.
2. Social and racial status of personnel, including:
   a. Wages.
   b. Intelligence, etc.
3. Working and welfare conditions of organization:
   a. Sanitation of place of work.
   b. Hours and rest periods.
   c. Rest rooms and lunch rooms.
4. Financial assistance available from:
   a. Company funds.
   b. Benefit associations.
   c. Local charitable organizations.
   d. Family resources.
5. Medical care provided by organization.
6. Local facilities for care:
   a. Hospitals.
   b. Sanatoria.
   c. Dispensaries.
   d. Home medical and nursing care, supplied by local health authorities, or private organizations.

All of the above factors vary widely in different localities and in different business organizations. But given a fixed set of conditions, standards of procedure may be worked out, observance of which will be of the greatest assistance to lay executives, physicians and nurses, and lastly and most important, to the patients themselves.

The procedure described here is the one followed in the Eastern Group of Telephone Companies of the Bell Telephone System, comprising about 65,000 employees. Here the best of conditions obtain under each of the six groups mentioned above. The personnel consists of semi-skilled, skilled and clerical labor, of high intelligence, good social status, and receiving good wages. The conditions under which the employees work are of the very best, the companies realizing that good light and ventilation, rest and retiring rooms, lunch rooms supplying appetizing food, and frequent rest intervals, pay for themselves many times over in a healthy and happy working force. There are no occupational diseases in the telephone industry. Because a large proportion of telephone employees come from the age group that is particularly liable to pulmonary and nervous disorders, they have their share of such ailments. But the incidence is well below that of the general public, and that of most other business organizations. A generous Benefit Fund (maintained by the companies with no contributions from employees) furnishes ample care in accident and sickness, and also provides for pensions, death benefits, etc. Medical departments, with physicians, nurses, excellent quarters and adequate equipment, are maintained. The local facilities for care are extremely good, particularly in New York, where hospital, sanatorium, and dispensary care is readily available, and is of a high degree of excellence.

* Received for publication F eb. 2 6, 1920.

The three main problems in dealing with industrial tuberculosis in such an organization are:

1. The elimination of tuberculosis from the organization: This can be accomplished by medical examination of all applicants, and periodic re-examinations of employees, and in no other way.

2. The protection of others: The accepted methods for the protection of others against infection are well known, and do not need repetition.

3. The care and disposition of tuberculous employees, the objects in view being:

   a. To secure recovery and return to work,
   b. Failing in that, to rehabilitate as far as possible and secure proper living conditions,
   c. To care for advanced cases.

As in almost every other business organization, medical recommendations for the care of tuberculous employees, involving financial aid and leave of absence, are passed on by lay officers. To them the economic prognosis is of first importance. This, together with length of service and quality of work, determines the amount and duration of assistance. Technical terms are not understood or desired. In the telephone companies the cases are widely scattered, and are seen by different physicians. A simple, practical classification, with an accepted method of disposition for each class, is, therefore, not only desirable but necessary, and some standard recommendation form should be used, giving only the information desired by the laymen. To meet this necessity the following standards of classification and disposition were introduced, and have given good results and satisfaction to all concerned.

Classification of Cases

1. *Very Incipient.* — Slight lesion; no tubercle bacilli ever found in sputum; general condition fair to good; diagnosis confirmed by X-ray. Such very early incipient cases, with proper care, recover in most instances, the employees returning to work within two or three months, often without knowing they have had tuberculosis. Early recognition is most important, as further progress markedly lessens the chances of recovery. In these cases, with their favorable outlook, special assistance is usually justifiable both from a humanitarian as well as from an economic standpoint. Being non-infectious, they may and should be treated at rest homes, not especially intended for or associated with tuberculosis. Where such homes are not available, they should be sent to sanatoria for incipient cases. To secure the best results neither these cases nor those in Group 2, as a general rule, should be allowed to remain at home, under original conditions, even with the best of medical and nursing care. Time is an important element, and the diagnosis of "possible tuberculosis" should be made as speedily as possible, without delays for repeated sputum examinations, prolonged temperature observations, and consultation examinations. True, many of the cases have not tuberculosis at all, but the patients are ill and need care, as shown by loss of weight, elevation of temperature, disturbed digestion and abnormal lung findings.

Of a consecutive group of forty-two such cases, thirty-eight returned to and remained at work, after an average absence of three months. A considerable proportion of these cases are probably not tuberculous; the same is true of ordinary sanatorium figures. Rest-home treatment obviates the stigma of tuberculosis, often unjustified, yet crippling activity throughout life. Sanatorium treatment is the only other resource.

2. *Early Favorable.* — Moderate lesion; tubercle bacilli present now or formerly; condition fair to good. These early favor-

MEDICAL DEPARTMENT

FORWARDED TO
FOR HIS INFORMATION. THIS COPY FOR HIS FILE. ORIGINAL FORWARDED TO EMPLOYEES' BENEFIT FUND COMMITTEE, ANY RECOMMENDATION FOR "OTHER BENEFITS" FOR DEPENDENTS SHOULD BE ORIGINATED AND FORWARDED AS SOON AS POSSIBLE

Medical Officer

CASE OF TUBERCULOSIS
REPORT AND RECOMMENDATION

.....19.....

TO
FROM
Examination of..... Occupation.....
Department..... Division..... Business Address.....

Amount of Lung Involvement.....
..... Cavities ?.....
Stage of Disease 1, 2, 3, 4 ? ..... Fever ?.....
Sputum: Pos. / Neg.....191 Prospect of Recovery and Return to Work.....
Home Care .....
Family Circumstances .....
Probable Duration of Absence..... Months until.....19

RECOMMENDATION: (Cross out numbers not used)

AT HOME

1. Employee May Safely Remain at Home Until .....where { he / she } will receive proper medical and nursing care, and all necessary precautions will be observed.
Weekly Cost for Medical Care.....

Continue at

IN INST.

2. Employee Should Enter .....
Weekly Cost..... Extras..... Railroad.....
.....
.....

ELSE-WHERE

3. .....
Weekly Cost .....

REMARKS: (If Rest Home Case Use Notation No. 2 under "Remarks") .....
.....
.....
.....
.....

.....M.D.

Approved and Forwarded to Employees' Benefit Fund Committee .....M.D.
MEDICAL DIRECTOR

Approved and Forwarded to Medical Director .....M.D.
MEDICAL OFFICER

(FRONT)

INFORMATION FOR PHYSICIANS

In giving the information called for on the face of the report the examining physician is requested to observe the following:

AMOUNT OF LUNG INVOLVEMENT: Information is desired as to what lobes are involved, existence of cavities, if pleurisy is present, etc.

STAGE OF DISEASE: This is to be stated as

1. Very Incipient. (Sputum has never shown tubercle bacilli; general condition excellent; prospect of early return to work good.)
2. Early Favorable. (Sputum has shown tubercle bacilli; general condition good; prospect of recovery and return to work good.)
3. Moderately Advanced. (Sputum as in 2; general condition fair to good; prospect of complete recovery and return to continuous work poor.)
4. Advanced. (Sputum as in 2; general condition poor; fever, etc.; no prospect of return to work.)

In estimating stage of disease, the amount of physical disability, presence of fever, etc., must be considered, as well as extent of lesion.

PROSPECT OF RECOVERY AND RETURN TO WORK: This should be stated as Good — Fair — Bad — None. The question of permanent return to work is important, as the sputum must be negative.

HOME CARE: This should include housing conditions, whether patient has separate room and bed, proper and sufficient food, and if necessary precautions to protect others are being observed.

FAMILY CIRCUMSTANCES: Should be described as Good — Fair — Poor — Very Bad.

DURATION OF ABSENCE: The period of absence in cases in the first and second stages should not exceed three months. It will be extended if necessary. In stage four, six months should be recommended.

RECOMMENDATION: In recommending that a patient remain at home, the physician should make sure that the patient will have good care, proper and sufficient food, continuous medical attention, and that necessary precautions to protect others are observed. He should consider the real interests of the patient and the family, and not be unduly influenced by unwillingness to enter a sanatorium or other institution, from fear of homesickness or other inadequate reason. Cases in an early stage, and with a relatively good prospect of recovery and permanent return to work, should enter sanatoria and not be sent to institutions where they will come in contact with advanced cases. More advanced cases should not be sent to sanatoria. If the home conditions are not satisfactory, and medical care is required, they should enter a tuberculosis hospital.

(BACK)

able cases (with positive sputum) are dangerous to others, and should be treated in special tuberculosis sanatoria. The outlook for recovery and return to work is still quite good, although from six to nine months are usually required. Such cases, to ensure recovery, should be sent to sanatoria for incipient cases only. They should not be sent to general tuberculosis institutions, where the association with advanced cases is depressing and harmful. Some free state or city sanatoria are, therefore, not advantageous, as they receive all groups of cases.

3. *Moderately Advanced.* — Lesion moderate to extensive; there may be continued fever; tubercle bacilli as in Group 2; condition fair to poor. These moderately advanced cases, with proper care and little or no work, sometimes remain in relatively good health for years. But return to work is usually only temporary, is often followed by relapse, and should not be encouraged. Because of the slight chance of complete recovery, such cases should not be sent to expensive sanatoria which are intended for the permanent restoration to health of incipient cases, and where they stand in the way of curable cases. When institution care is indicated, they should be cared for in private, semi-private, or free tuberculosis institutions accepting cases in the more advanced stages. But many may safely remain at home, provided they receive proper care and observe the necessary precautions to protect others, particularly children. A short period of instruction at a sanatorium is often warranted.

4. *Advanced.* — These cases include all that the name implies — patients in whom the disease is progressing to its termination. Such advanced tuberculous patients, with no chance of recovery and return to work, are usually better off at home with their families, if the conditions are satisfactory. Before hurrying them into an institution, an attempt should be made to correct unsatisfactory home conditions, and so make removal unnecessary. Less money is required to furnish satisfactory sleeping conditions, good food and medical care at the home than in an institution. Where unfavorable home conditions make it necessary, however, they should be sent to free, or very moderate priced hospitals, as near their homes as possible. As in Group 3, sanatorium care should not be recommended, an additional reason being that sanatoria are not equipped to furnish the additional nursing and medical care required in such cases.

Récommendation Form: The form used for submitting recommendations for medical care is shown herewith. Instructions for the examining physician are given on the reverse. The examining physician is responsible for the classification of the case and the prognosis. The investigation of home and family conditions is, of course, best made by nurses. The period of absence set should be three months in all cases with a prospect of recovery and return to work. At least six months should be recommended in others.

Progress Reports: Each case should be followed up monthly, and information obtained as to condition.

Return to Work: Even after return to work, cases should be kept under observation, and should be re-examined every two or three months for a year.

Results

No figures can be given as to the total number of cases in each class for any particular period of time, nor as to the results. In the metropolitan area of the New York Telephone Company, 29 per cent. of all cases of pulmonary tuberculosis under observation during 1918 and 1919 have returned to and continued on duty. Eventually, with better facilities for early recognition and prompt institution of treatment,

the proportion of recoveries should reach 50 per cent. During the same time, the proportion of advanced cases fell from 35 per cent. to 10 per cent., the moderately advanced from 40 per cent. to 20 per cent., with corresponding increases in the two early classes. Many moderately advanced and advanced cases have been safely and happily returned to their homes and families from institutions. This alone was well worth accomplishing.

Summary

An attempt has been made to set forth the following:

1. That, where possible, a standard method of procedure should be adopted in caring for cases of tuberculosis in industry.

2. That the procedure should be adapted to the needs of lay executives, and based on economic prognosis.

3. That cases in the earliest stages, including those only suspected of having the disease, should be constantly sought for and at once put under treatment in rest homes, with a view to early and permanent recovery.

4. That such cases should not be stigmatized as having tuberculosis.

5. That many cases, in which the economic prognosis is poor, are cared for better and more cheaply at their homes than in institutions.

ANTHRAX*

THOMAS M. LEGGE, M.D., D.P.H.
His Majesty's Medical Inspector of Factories

IN the romance of medicine — tracing the cause of disease and trying to find the means of prevention or a cure when it occurs — anthrax takes a high place. Anthrax is a fatal disease affecting certain animals, especially horses, cattle, sheep and goats, which may be conveyed from them to man. In Great Britain, Australia, and the United States, the disease is comparatively rare, but in uncivilised countries where precautions are not taken to prevent it, as in Russia, Turkey, Persia, India, China, Siberia, and South Africa, it is common, and much infected material is often shipped to British ports.

The following table shows the incidence of anthrax in Great Britain between the years 1909 and 1918.

INCIDENCE OF ANTHRAX[1]

Industry	1909–1913	1914–1918
Wool	165^{26}	242^{31}
Horsehair	34^{5}	20^{6}
Hides and skins	79^{11}	94^{11}
Other industries	10^{3}	18^{3}
Total	288^{45}	374^{51}

[1] The inferior figures refer to cases, the superior figures to deaths.

The essential cause of anthrax is a tiny rod-shaped bacillus which has to be magnified 300 times before it can be properly seen. This bacillus, once it has gained access to the blood, multiplies so rapidly that it chokes the blood vessels. If an animal dead of anthrax is immediately buried without the carcass being opened or the skin removed, no risk to man or other animals is run; but once the blood is allowed to come into contact with air, the bacilli form seeds or spores which are far more difficult to destroy than the bacilli themselves. These spores can remain alive for years, and any fleece, wool, skin or other part of the carcass upon which blood has escaped will contain myriads of them. Fleeces, hides, and skins containing the spores come to this country in a dry condition and when unshipped at the docks or opened in the factories may be the source of dust particles to which spores are attached. This dust may readily come in contact with cuts or scratches — even ones that cannot be seen by the naked eye — on the neck, face, or any part of the body of men handling the hides. The spores may then develop into bacilli and multiply rapidly, giving rise to a sore with a black center surrounded by blebs — the lesion characteristic of the external form of anthrax. Now is the time for treatment and the earlier this is undertaken by recourse to the surgeon's knife or to injection of anti-anthrax serum, so much greater is the chance of recovery. Sometimes the spores, instead of alighting on the skin, may be inhaled into the lungs and penetrate from there to the blood stream giving rise to the form of anthrax known as wool-sorters' disease. The early symptoms in these cases may be mistaken for those of influenza. This form of anthrax is invariably fatal, but fortunately much less common than the external.

This, as briefly as I can put it, is the bald outline of what anthrax is. Yet when I describe to you some of my experiences, you will see the dramatic and wonderful nature of the disease. I sometimes feel that there must be a collective mind in the world of anthrax bacilli, with an instinct

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for surprising and for getting the better of all man's efforts against them, just as there is an instinct in the fox to be cunning, and in the bee to make honey, or to sting you if you interfere with it. This is, perhaps, putting the matter in a ridiculous way but, nevertheless, anthrax so far has always been the victor. It always makes a frontal attack and is, in this respect, a splendid antagonist, so different from lead poisoning or fibroid phthisis — slinking and slow diseases, taking years to develop and incapacitate. For anthrax, a fortnight is time enough for either cure or kill. And anthrax is no respecter of persons; the very strong and robust succumb as readily as the weak. I remember once, after attending an inquest on a fatal case in a worsted factory, having a sorter pointed out to me as the strongest of the strong, and as having been exposed for nineteen years with impunity to daily risk of infection. A week later I was present at the inquest on his body. And in London I remember attending an inquest on a boy employed in an ironmonger's shop, who had contracted anthrax through wearing the scarf of his brother who worked in a horsehair factory — as his mother related to the coroner. And a week later I attended the inquest on the body of the mother who had nursed her boy.

If one day I say to myself, " How strange it is that anthrax does not seem to occur on the fingers," I am pretty sure to find that the collective mind of anthrax has decreed that the next case shall be on the finger! I am not superstitious — far from it — but coincidence after coincidence of the kind I have related has inspired in me a respect for anthrax which I wish to convey to you and which I ask you to share, while I go on to describe the solution of the problem of anthrax which we think we have reached in England so far as the worsted and woollen trade is concerned.

The actual number of cases of anthrax in man is not large — perhaps one hundred a year, of which twenty to twenty-five prove fatal. But numbers do not count in the matter of seeking to prevent a fatal disease. When you compare the number of deaths annually due to anthrax with the number due to measles, say 30 as against 12,000, it is a matter for surprise that anthrax is so much dreaded and that measles is looked upon as a comparatively trivial complaint. A quarter of a century ago the deaths from hydrophobia annually numbered perhaps two or three, yet no one hesitated in saying that every means must be adopted to eradicate so horrible a disease, and for months the importation of dogs was interdicted and the disease finally stamped out. Medical science will not rest until all that can be done in this direction has been done. And industry will do well to demand that the knowledge so gained is properly applied to assuage the suffering which will otherwise inevitably occur.

Here I would like to pay a tribute to the work done by the Bradford Anthrax Investigation Board, formed in 1905, which is a signal instance of the recognition by enlightened members of a great industry of their duty to combat in every way in their power any menace to life or health inherent in the materials used in the industry in question. When the work of the Bradford board commenced we were extraordinarily ignorant of the classes of wool and hair infected, how largely they were infected, and of how often in a case of anthrax the bacillus would be found in the blood clots or in the wool in which no blood could be detected. It was this board which made the first sustained effort to determine how far it was possible to disinfect worsted and wool by steam or chemical means. Thousands of samples of wool were examined and anthrax found in a surprising number — sometimes where least expected, as in Russian pulled stockings. Without the work of the anthrax investigation board, I should not be here to tell you of

the solution of the problem of anthrax in wool.

Anthrax-infected material is either of high grade or of low grade. Of high grade infected materials, the most important are Cape mohair, Turkey mohair, and alpaca. The low grade infected materials comprise all those from the southern, central, and western areas of Asia with, in addition, inferior qualities of alpaca, and of Cape mohair. These materials are regarded as the most dangerous because it has been found over many years that the persons handling them have suffered most from anthrax. The order in which I should rank them according to danger would be as follows:

East Indian wool and goat hair	96^{10}
Persian wool	62^{14}
Turkey mohair	27^{4}
Camel hair	10^{6}
Van mohair	8^{2}
Cape mohair	5
Alpaca	3
Cow hair	2
Australian and New Zealand wools	4
Home wools	2

The routes by which the wool travels are of importance as showing where disinfecting stations should be located in order to prevent the arrival of infected material in England. Thus, wool from Central Asia may travel south to Karachi and thence to Liverpool, or north to Bokhara, Nijni Novgorod, etc., and thence overland via the Caspian to the Black Sea, or across Russia to the Baltic ports for shipment.

Let us consider for a moment what the processes are through which these infected woollen materials pass when they arrive at the factory. You must remember that even before arrival at the factory some risk of anthrax has been run, first, by the workpeople concerned in transport, and secondly, by buyers and warehousemen in warehouses at the ports where materials are stored. Dust is inseparable from each of the early operations before the materials are washed. Washing, however, is only practised in the case of worsted, the principal object in the cleaning of wool being the removal of the sand, often present to the extent of 30 per cent. of the weight. The first procedure in unpacking consists in breaking the bands of the hydraulically packed bales — a process accompanied by the evolution of dust. Next comes the opening and sorting of the fleeces so as to divide them according to length, quality, and color. They are then blended and the blend fed into a wash bowl. I call your attention especially to the wash bowl used at this point because the suggested method of disinfection depends on the preliminary washing and disinfection by chemical means in a modified apparatus of the same kind. After washing, the wool is dried, is fed into what is called the hopper of the card, and is then passed into a preparing machine where the fibers are separated, one from the other, by steel points and are brought approximately parallel to one another. The fibers are then gathered into the sliver. The sliver in the case of worsted is subsequently combed, the long fibers being separated from the short and rolled into balls of " tops," while the short, called " noils," are collected and subsequently used in the woollen and felt trades. The great fact to remember in these processes is that before washing and carding the coarse dust in the hair is the danger, and in the carding and subsequent processes there is still dust — so fine that you hardly notice it — given off by the separation of one fiber from another. Anthrax spores come off attached to these particles of dust.

For a long time it was thought that the washing process cleaned the wool sufficiently by removing the blood and dirt to which anthrax spores adhere. But so many cases of anthrax arose in the later processes of combing and spinning, it became clear that, while many spores no doubt

were removed in washing, the blood-clots containing them became broken up in the wash bowl and entangled in wool which previously had been free from them, and that free bacilli suspended in the water itself impregnated the wool. The last state, therefore, became worse than the first. In the worsted industry more cases occur, after washing, than before, and in the woollen industry, after carding, than before.

Now, what has been done to prevent anthrax in the factory ? For forty years past, preventive attempts have been made by rules and regulations centering in the effort (1) to remove and suppress dust — which is impossible wholly to do — (2) to separate out fallen fleeces, that is, those which look as though the animal had not died a natural death — a matter often impossible to decide — and (3) to warn the workpeople of the importance of early recognition of the disease, and of early treatment — warnings which unfortunately are not always acted upon. Latterly, without any regulations, praiseworthy effort has been made to remove blood clots from the wool, and in certain factories, where specially dangerous materials are handled, to follow up cases of absenteeism in workers by the visit of a medical man, expert in the diagnosis of anthrax, with a view to the earliest possible treatment. I cannot emphasise this last point too much; of the cases seen by the special doctor referred to, 74 per cent. have been mild cases, and only 7.4 per cent. fatal, whereas of the ordinary cases coming to the Bradford Infirmary 50 per cent. only have been mild, and 15 per cent. have proved fatal.

I have no doubt that all these preventive measures have played a part and that if they had not been adopted the number of cases and the fatality from anthrax would have been greater. The following figures of incidence of anthrax, however, in the wool industry for five-year periods show how the measures used have failed even to prevent an increase in the number of cases:

1896 to 1900	1901 to 1905	1906 to 1910	1911 to 1915	1916 to 1920 (4 years)
56^{12}	98^{29}	130^{21}	164^{28}	327^{45}

The inferior figures indicate the number of cases; the superior figures, the number of deaths.

The reason for the increase in the number of cases of anthrax is that the disease is not caused by a known chemical compound or other inanimate substance used in manufacture, but by a living organism accidentally attached to the material handled and giving no evidence of its presence there. The remedies applied so far have all been directed at treating the effect and not the cause. And so long as the cause remains it is potent for mischief, not only in the dust in the factory, but also in the waste waters flowing into the drains or in the waste products sold as fertilizer.

There are only two possible ways of treating the cause and so preventing anthrax. The first is to prevent animals from contracting the disease, and the other is to destroy the germs after the disease has been contracted. Hitherto both have been considered too formidable to attempt. No one could entertain any hope that the nomadic tribes in central Asia or any uncivilised country would take rational steps to stamp out anthrax in animals. So fatuous is the suggestion, I will not waste time in further alluding to it. On the other hand, while the problem of disinfection appals by its magnitude, if practicable, the countries of the world would be prepared to make effort to give it effect for the dangerous classes of wool from central and southern Asia, etc., where alone it would be necessary. Hitherto, except as regards horsehair, no method of disinfection has availed to destroy the bacilli or spores without at the same time destroying the material. Steam under pressure at a temperature of 225°F. is by far the best disin-

fectant. Spores exposed naked to this temperature are killed with certainty in from five to ten minutes, and even if wrapped up in many folds of blankets or in fleeces, the steam will penetrate to them and will cause their destruction in half an hour. Infected horsehair from such countries as China, Russia, and Siberia, although not improved in quality or for manufacturing purposes by the process, can rightly be subjected to steam in order to safeguard the workers. White hair, however, is turned yellow in the process and so is wool, but what prohibits steam in the case of wool is that the fiber loses its strength and elasticity if exposed to it.

Such was the position which faced the anthrax committee appointed in 1913 to revise the woolcombing regulations. They had either to recommend harassing restrictions on the manipulation of wool in the factory without believing that these restrictions would do more than reduce by a very little incidence of anthrax in the workers; or they had to set about trying to find a method of disinfection, up to that time believed to be impracticable. Fortunately, on the committee in question was Dr. Eurich, the bacteriologist of the anthrax investigation board, and the secretary, Mr. G. Elmhirst Duckering, a skilled chemist. They envisaged the problem thus: Our task is first to rid the spores of all their protective clothing in the way of blood and grease, and then to kill them by the disinfectant. There were thus two separate stages in the process.

In the basement of the conditioning house at Bradford, experimental tanks were arranged, specially highly infected blood clots were made, dried, rolled up in wool, and placed in one tank. Here they were raked backwards and forwards, first in cold water, next, as this was not very successful, in warm water, and finally, as experience taught, for twenty minutes in warm water containing some soap solution and a little sodium carbonate. Then, and as part of this process, the wool containing the softened clots was squeezed three times between rollers. The effect of this was to squeeze out nine-tenths of the blood and leave it behind in the tank of warm water and alkali. The wool with very little blood adhering to it was then placed in another bath of warm water containing $2\frac{1}{2}$ per cent. of formaldehyde. Formaldehyde is a powerful disinfectant, and the blood and wool, after being moved about in it for twenty minutes were found to be practically free from all living bacilli and spores. This result naturally was not attained all at once. Some 130 experiments altogether were carried out, and the committee concluded that if the spores were properly freed there could be no doubt of the subsequent destruction of practically all the spores by the $2\frac{1}{2}$ per cent. formaldehyde. I say " practically all," and to make it certain that all should be destroyed they recommended further that the wool should be dried with the formaldehyde still upon it in order that it might go on exerting a disinfecting effect.

The process is simplicity itself, but you will understand that disinfection to be really effective must be most carefully controlled. The first question to consider is where shall the disinfection be done — in the factory or elsewhere ? Against disinfection in the factory is, first, the difficulty of ensuring that the process be precisely followed — the breaking up of the blood clots and exposure of the spores, the strength of the disinfecting solution and the rest. A special apparatus would have to be installed, and a very large apparatus, too. But the most powerful argument against disinfection on factory premises is the fact that the bales would all have to be opened before immersion in the bath and none of the people, therefore, who handle the wool prior to disinfection would be protected. The same risk would be run in transport,

on ships, at the docks, and in the warehouses. If not in the factory, where then should disinfection be done? There are only two points at which wool is concentrated — the one at the point of export and the other at the port of arrival. It must, therefore, be disinfected at one or the other of these points.

The advantages of carrying out the disinfection at the two principal ports by which wool enters Great Britain — Liverpool and London — are, first, that we know it would be done efficiently and in two places only. This, however, would only protect the workers in factories in that country, and would not protect those in France, the United States, and other countries to which wool goes. You may say these countries can protect themselves by setting up disinfecting stations of their own. This is true, but cannot a better method be devised because, after all, if disinfection is carried out in home ports all the dangerous processes of opening the bales and repacking and rebaling, which had been already done before export, will have to be repeated. If only the process could be done once for all before the initial packing and baling in the country of export, you would first destroy the spores at an early stage; secondly, remove the danger in transport; thirdly, clean the wool and free it from much of the sand now mixed with it — in short, from the starting-point make it safer and cleaner to handle in every way.

This is what the anthrax committee have recommended, and the way they propose it should be done is by the formation of a disinfection authority appointed by the British government, whose duty it would be to erect the necessary disinfection stations in foreign countries, carry out the disinfection by their own officers, and affix their seal of disinfection to every bale. Each disinfecting station would have a superintendent engineer and also a chemist to see that the solutions were of the proper strength and to test samples of the material as to their freedom from anthrax spores. The general work of the station would be carried out by native labor. The committee definitely recommend establishment of such stations at Karachi and Bombay to deal with East Indian wool; another at Basra in the Persian Gulf, for Persian wool; and a third at Cairo for Egyptian wool. They think also that there must at any rate be one disinfecting station in England for the material which may arrive undisinfected, and that this station should be the first to be erected so as to make a beginning and to gain experience as to the best type of apparatus.

These in brief are the proposals. And how is the cost to be defrayed? Disinfection must be made to pay for itself by a charge on the wool disinfected. The committee estimate that the cost of erection of stations to deal with the eighty million pounds of Asiatic and Egyptian wool will be £250,000. By levying a charge of about 3 halfpence per pound on the wool disinfected, this cost will be covered. In considering this additional charge on the purchase of the wool, users of it must bear in mind the extra charge they now incur because of the risk of anthrax. Thus, annually a commission factory in Bradford has paid over £1,000 for the upkeep of fans and other requirements of the woolcombing regulations and for compensation for illness and death attributable to anthrax. In the same factory the capital cost of the apparatus necessary for prevention of anthrax and dust has been over £1,000 and yet real relief has not been, and is not likely to be, secured.

Let us look forward now to the state of affairs which may exist in the dangerous wool trade, shall I say, five years hence. By that time normal trade will be established on a greater scale than ever with each person trying to effect the greatest

efficiency in his own branch, and, as a result of the war conditions, that part of the world where chance of reform before was most hopeless — Turkey, Asia Minor and Persia — will have been transformed. They will be amenable to British requirements. Stations under the British disinfecting authority will have been established in the Persian Gulf, in Karachi, Bombay and Cairo, and all wool from there will come over, clear of sand and dirt and free from danger. Constantinople will be internationalised, and will have become a clean city where the requirements of the disinfection authorities will be carried out. Russia will be recovering and will have entered into co-operation with us as to disinfection. South Africa will have taken steps, in imitation of Australia and New Zealand, to stamp out anthrax. At home what will be the result ? Bradford and the West Riding, Kidderminster, the Rossendale valley of Lancashire and Kilmarnock will be largely freed from the nightmare of anthrax; the excessively dusty processes in the breaking of the bales and blending will be nearly dust free, and necessity for regulations will have largely ceased to exist. But while those regulations directed against the danger of anthrax may be superfluous, you will readily acknowledge that nothing in them which makes for the greater comfort and well-being of the workers could be withdrawn. Indeed, all look forward to better welfare provision being made not only in factories where dangerous wools are used, but also in all worsted and woollen factories. This is what I believe will be done — welfare arrangements in factories will take the place of restrictions directed against anthrax, the danger of which will be largely a thing of the past.

Anthrax, however, is not limited to wool. Generally speaking, there are as many cases every year among hide and skin workers, horsehair workers, and others as there are among wool workers. No man likes to think that the spores of anthrax lurk in his shaving brush, but it is literally true that spores have been found in shaving brushes during the war and hundreds of thousands of brushes have been destroyed in consequence. The duty of the disinfection authority is, therefore, to rid all animal tissue used industrially of the risk of conveying anthrax infection.

INDUSTRIAL HYGIENE IN THE HIGH SCHOOL OF COMMERCE*

MICHAEL LEVINE

Department of Biology of the High School of Commerce, New York City

A GREAT vocational high school like the High School of Commerce with an enrolment of 3750 boys has a clear mandate from the community. The return of industry to its normal condition lays a burden upon such an institution to do its share in solving those problems in industrial organization upon which scores of social agencies are now engaged. The demand for men and women who are to direct the industrial workers and to administer to the needs that arise in the stress of industrial occupations, has already been felt by our leading universities. The establishment of higher schools for the study of hygiene is, however, not entirely adequate and does not directly affect the industrial worker. It is a well recognized fact that the industrial world is supplied annually with a host of immature and sub-normal recruits whose improvement must come, to an extent at least, from activities within their own ranks.

This need of preparing the workers for better living has found expression in some states by the formulation of laws for direct instruction in hygiene. The Welsh-Slatter Law, a measure passed by the New York legislature in 1917, for instance, makes the study of hygiene a required subject in all high schools of the state. The law fills a long felt want, but it does not prescribe the content of the course, and the teachers have, therefore, been compelled to develop for themselves the phases of the work which ought to be stressed.

In the High School of Commerce it has been our purpose to develop the course so that the study of industrial hygiene should rest as a cap stone on our work. The work of the four years is, therefore, divided in general into four groups:

1. Personal hygiene.
2. Hygiene of the home.
3. Hygiene of the community.
4. Hygiene of industry.

The work in personal hygiene in the first year is merely an elaboration of the work done in physiology and general biology, with special emphasis on the phase of life which the pupils are experiencing. Such topics as feeding, digestion, circulation, respiration, ventilation, excretion, bathing, clothing, personal cleanliness, and appearances, are dealt with. The subject of hy-

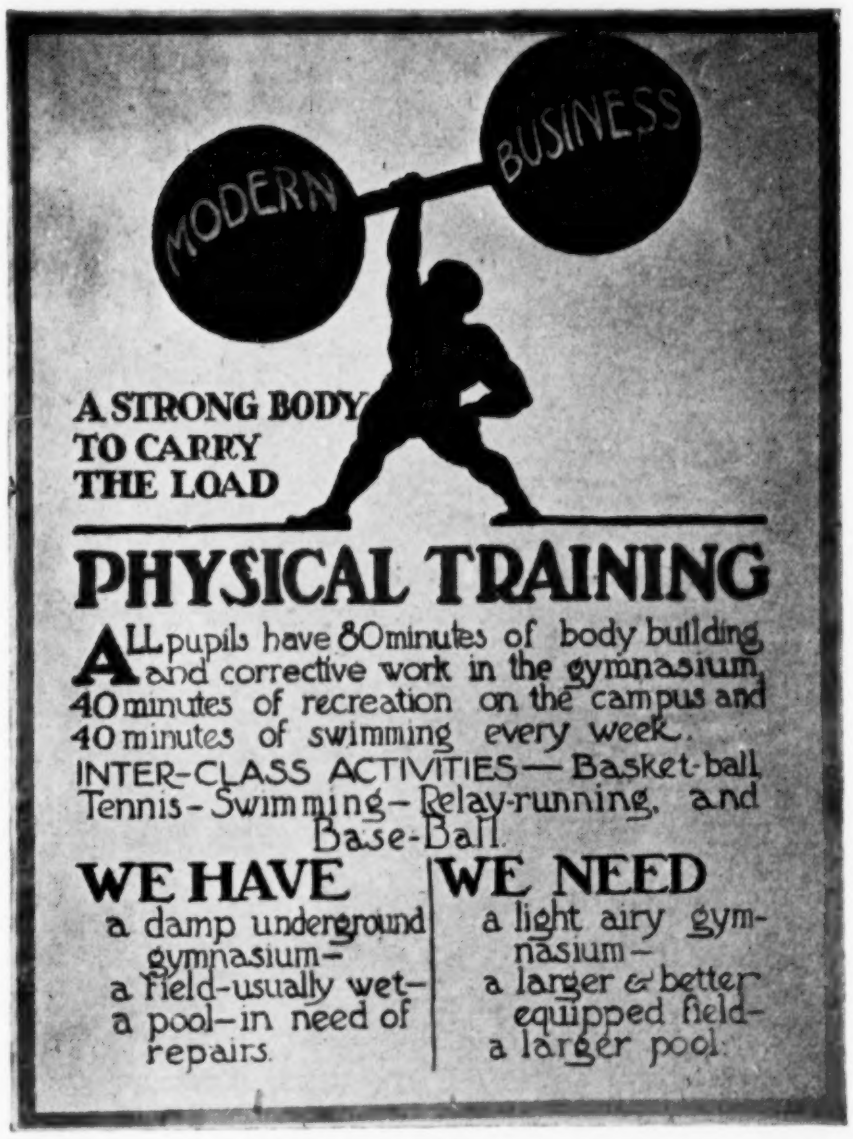
MODERN
BUSINESS
A STRONG BODY
TO CARRY
THE LOAD
PHYSICAL TRAINING
ALL pupils have 80 minutes of body building and corrective work in the gymnasium, 40 minutes of recreation on the campus and 40 minutes of swimming every week.
INTER-CLASS ACTIVITIES — Basket-ball, Tennis - Swimming - Relay-running, and Base-Ball.
WE HAVE
a damp underground gymnasium -
a field-usually wet -
a pool - in need of repairs.
WE NEED
a light airy gymnasium -
a larger & better equipped field -
a larger pool.

FIG. 1. — Photograph of a poster showing what the High School of Commerce is doing for its pupils through its physical training work.

* Received for publication March 31, 1920.

giene of the home and community, assigned to students in the second and third years of the course, deals mainly with the broader questions of health and disease which are truly community problems. This is associated with studies of bacteria and other organisms whose activities are utilized by man in the production of materials necessary to him.

Thus far, the work as it is here briefly outlined probably corresponds in the main to the courses given in other schools. The temptation to devote the fourth year to review exercises and to mere physical examinations is undoubtedly great. Until recently the application of general principles in the course in the high schools was, as far as we know, never satisfactorily made, and consequently hygiene in the fourth year was generally characterized as weak and inefficient. In the High School of Commerce the effort to make this subject in the last year of school of vital and practical importance has led us to develop the course in industrial hygiene. Now we find that the three years' work in personal hygiene and community hygiene has been vitalized. It has become real and practical.

Lunch Service
Good, nourishing food at lowest cost
2000 boys are fed daily
7 paid employes in lunch-room
50 boys are employed daily
ANNUAL SALES AMOUNT TO OVER $25,000
The food is sold at cost—profit less than ½ %
WE BUY GOOD FOOD, and CONTROL PREPARATION
WE NEED a larger kitchen, a larger, more cheerful lunch-room, and more sanitary facilities

FIG. 2. — Photograph of a poster showing what the High School of Commerce is doing in the pupils' lunch room.

FIG. 3. — Photograph of a poster made by the Commerce Art Department for a parents' meeting showing what the High School of Commerce is trying to do for the New York City boy through its work in industrial hygiene.

The four years' course, including as it does the study of industrial hygiene in the fourth year, really functions much better than a prolonged discussion of personal and community hygiene.

This does not mean that in the High School of Commerce we do not realize that personal hygiene is of great importance. At the same time, we feel that it leads naturally to the broader problem of production and, therefore, it is this aspect we have endeavored to stress. Thus our aims are fourfold. We are endeavoring:

1. To inculcate a hygienic sense of cleanliness, neatness and general pride.

2. To acquaint the student with the various industries and their concomitant dangers to health and life.

3. To study the means and devices for protection of the worker against industrial hazard.

4. To give the pupil an interest in the general problems of living, which tend to establish better relations from a hygienic point of view between the employer and the employee.

We are making an effort to send to the industrial world a young man who is not only interested in and understands his business relations, but also one who understands the health forces which enable him to realize that the body is a machine worthy of the care and the consideration that he gives to the machines which he is employed to direct. We are trying to fit the boy physically for his career and to teach him the principles of right living. With these aims in view the work in industrial hygiene is presented in the High School of Commerce briefly as follows: *

I. The social forces at work which make for the health of the citizen are first studied. Under this heading are included the organization and the activities of the health department, department of charities, state department of health, public health service, and the industrial commissions. There organizations are treated briefly, emphasis being placed especially upon the relation of these organizations to the industrial world.

II. This is followed by a study of the chief industries of the community and the mortality frequency in each. Statistics on the chief causes of death, compiled by the Metropolitan Life Insurance Company, the New York Life Insurance Company, and other agencies, are carefully compared. Occupational diseases are studied through the project method. Pupils report to the class on the working conditions in the various trades in which they are interested or in which their parents are engaged. Remedies are devised and suggested. Visits to factories and shops are encouraged, and reports based on these visits are heard. The Compensation Law is read and its effect upon the worker and upon the employer is discussed. Industrial fatigue and its relation to production, efficiency, disease, and industrial accidents, are studied through reports made by pupils. Finally, social welfare work, its relation to the employer and employee, its dangers and its benefits as carried on by the du Pont, Ford, and other industrial organizations are made the basis of discussion. Industrial and health insurance in America are compared with conditions that pertain in foreign countries.

In this way the course in industrial hygiene in the High School of Commerce comes as a fitting climax, and gives the boys who are about to graduate a vital appreciation of those hygienic principles which are being applied in the industrial life of the community of which they will be a vital part.

To Dr. Arthur M. Wolfson, Principal of the High School of Commerce, I wish to express my sincere thanks for many suggestions and the encouragement given me during the progress of this work.

* A more detailed outline of this course has been published by the author in the Bulletin of High Points (a monthly publication issued by the Board of Education of N.Y.C.), 1919, 1, 23–24.

THE HOUSING PROBLEM IN GREAT BRITAIN AND IRELAND*

JOHN S. HODGSON

Secretary of Housing Board, Massachusetts Department of Public Health

NO study of this subject would be other than misleading in the absence of due regard to certain principles which have long controlled English domestic policies. Briefly stated, there is an ingrained disposition to avoid governmental intervention in problems for which private initiative can furnish a solution. If this has sometimes been carried to the verge of *laissez faire*, the test of results is held largely to have justified reliance upon a preference admirably crystallized in the writings and speeches of Edmund Burke. Thus, in the field now to be reviewed, private enterprise had been responsible for 95 per cent. of all houses built before the war. Then, again, the commercial instincts of the English people have inevitably favored individualism as opposed to collectivism, with the result that even the best-intentioned efforts to secure the advantages derivable from centralized activity have been met with suspicion, if not with organized hostility.

These characteristics have found a wide field for their display in various phases of local government. The operation of the highly beneficial Poor Law Act of 1834, substituting for the haphazard and vicious methods of localized poor relief a system of grouped units, administered on accepted principles under the control of a central authority, evoked a degree of opposition difficult of comprehension by later generations. Offensive nicknames were applied to the three commissioners appointed under the act, and riots followed the circulation of stories that poisoned bread was being distributed by the relieving officers as a ready means of killing off paupers. Within the writer's recollection, the same repugnance to centralized control was manifested when, under the Public Health Acts of 1872 and 1875, extensive powers in regard to local expenditure and administration were conferred upon the Local Government Board, the creation of which, under the earlier of these acts, was no more than a development of the Poor Law Board. Yet it may be confidently asserted that any proposal to revert, in either case, to the old order would be vehemently opposed.

* Received for publication Feb. 27, 1920.

Early Conditions and Legislation

These acts are cited, not merely on account of their intrinsic importance but because they were largely the result of conditions inherent in the English factory system. A price had to be paid for the country's pre-eminence as "the workshop of the world," some of it at the time and some of it as an unwelcome legacy to succeeding generations. Under the impetus of philanthropic foresight, much ameliorative legislation for factory workers was enacted between 1819 and 1851, this including Lord Shaftesbury's Ten Hours Act of 1847, but the equally important factor of housing received scant attention in an era, the housing horrors of which were depicted by Disraeli in his early novels, *Sybil* and *Coningsby*. Even when Parliament turned aside from remedying factory conditions, it was the common lodging house, not the home of the worker as now understood, that secured its attention. Lord Shaftesbury's Common Lodging House Act, giving increased powers of inspection, was passed in 1851 and in the same year that great philanthropist carried a measure authorizing certain local authorities to erect public

lodging houses out of local revenues. A considerable advance in this direction was made in 1866 in the adoption of the principle of granting loans from the national exchequer to enable municipal authorities to carry out approved schemes of lodging-house construction.

In the Torrens Act of 1868 are found the germs of the well-known English acts of 1890 and 1909, so frequently cited by American municipal reformers. It was soon found, however, that the limited powers conferred were incapable of dealing with the "unwelcome legacy" already referred to. What came to be known as the Manchester School of Economic Thought, from its intimate association with the tenets of Cobden and Bright, had left its mark in large working-class areas, chiefly covered by what Mr. John Burns many years later aptly described as "brick boxes with slate lids." Not only were these dwellings deficient in what are now regarded as rudimentary essentials of construction and accommodation, but they were usually crowded too closely together and their sanitary provisions were too often dominated by the prevailing craze for cheapness. The persistence of these features can be realized adequately only by those who, as is the case with the writer, have been called upon to amend sanitary conditions of which they formed a part.

The Birmingham Clearance, Etc.

As a further effort, the Artisans' Dwellings Act of 1875 empowered local authorities to acquire property by compulsory purchase in order to deal with it as an "insanitary area," due provision being made for the rehousing of dispossessed tenants. It was in Birmingham, under the epoch-making mayoralty of Mr. Joseph Chamberlain, that the first application of these enhanced powers was effected. Under his guidance, the central area of the city was practically rebuilt after the removal of existing slums, and this was followed by the adoption of building ordinances going far beyond anything ever previously attempted in practice. In this way, the city was left in a condition enabling future operations to be carried on under the less expensive sections of the acts of 1890 and 1909, and thus became a pioneer in really economical administration in an apparently hopeless field.

Experience gained in the working of the Act of 1875 showed the need of amendment in the important domain of compensation for condemned property. "It was found that owners bought out under our improvement schemes frequently benefited from their own misdeeds, because arbitrators assessed the value of property simply according to rental and without reference to its sanitary condition. Accordingly, the amending acts provide that if the house is proved to have been at the date of the official representation a nuisance, then the arbiter shall fix what the value of the house would be with the nuisance abated, and shall deduct therefrom the probable cost of abating the nuisance." Besides this an impetus was given to the removal of displaced tenants to outside locations in preference to rehousing them in or near the former slum district, the earlier restriction in regard to rehousing being removed by amending the acts of 1879 and 1882.

The Housing of the Working Classes Act, 1890, crystallized the experience gained in the working of earlier legislation and practically embodied all that had been done by Parliament since 1851. The essential features of its three leading parts are as follows: *Part I*, dealing with unhealthy areas, authorizes schemes by local authorities subject to governmental confirmation, the provision of dwelling accommodation for families displaced by such schemes, and the proceedings entailed by the acquisition of land and buildings for the purposes of the act. *Part II* covers the procedure involved

in dealing with unhealthy dwellings. Its provisions embrace orders for compulsory closing and demolition, schemes for reconstruction, settlement of compensation, the financing of loans, and special provisions for London. *Part III* confers upon local authorities powers in regard to working-class lodging houses, with special provisions applying to loans to, and powers of, companies and societies.

The Housing and Town Planning Act, 1909, besides simplifying administration and procedure, extended the powers of all authorities and increased the supervisory functions of the Local Government Board, especially as a tribunal of appeal. Town planning received greater attention than in the earlier act. The appointment of medical officers of health by counties, as distinguished from cities, etc., was made obligatory, and various changes were made in the laws affecting the liability of property owners. The act did little, however, to meet the situation as far as the supply of new houses is concerned. It has been freely charged that this weak point in the act has contributed in no small degree to the existing rural house famine.

What Liverpool Has Done

It is impossible, within present limits, to enter upon any detailed discussion of operations under these far-reaching enactments. Nor must it be forgotten that many cities had taken effective steps, under earlier legislation, to remedy many of the more glaring defects resulting from chaotic planning, piecemeal sanitation, and short-sighted economy in civic inception and administration. Among the larger cities, Liverpool is entitled to a high place in the improvement of conditions so wretched as to be responsible for the Liverpool Sanitary Amendment Act of 1864. At that date, no fewer than 30,000 people were living in cellars and there were 22,000 insanitary "court" houses in the city — the homes of one-fifth of the population at that time. These conditions are depicted as follows in the City Housing Committee's Report for 1913:

> It cannot too often be recalled to mind that the whole of these court houses were back-to-back and side-to-side, and so situated that as many as six were built on each side of a narrow strip of land, 9 to 15 feet wide, closed up at each end with high buildings and approached through a long, narrow tunnel, thus forming courts into which the sun could not penetrate and in which the air could not circulate. In each of these courts, there lived from seventy-five to one hundred people. The houses were without closet accommodation, save as to two conveniences situated at the top of each court in full view of the inhabitants, and having one stand-pipe for the supply of water common to all the inhabitants.

Some of these structures, amended, of course, as regards sanitary provisions and living conditions, still remain, but each year sees their number reduced and their places taken by improved dwellings. In the twelve years ending with 1913, 6000 houses rented at or below $1.70 per week were built, including 2041 dwellings of two, three, and four rooms erected by the housing committee. In 1913, this committee had under its control 2747 buildings, of which 2734 were used as dwellings with an aggregate population of 10,223. The initial general death rate in the affected areas, ranging from 40 to 60 per thousand per annum, has fallen by more than one-half, while the average annual death rate from tuberculosis has dropped from 4 to 1.9 per thousand. It must be remembered that in Liverpool, as elsewhere, "the poverty and unsatisfactory habits of the tenants" were contributory factors to death rates of which it is scarcely possible to read without a shudder.

At the end of 1913, Liverpool had expended $5,660,000 * under the powers of

* Throughout this article, money conversions are based on par value: £1 = $4.87.

the Act of 1864, and the work is still going on.

Changing Conditions

The case of Liverpool, while not standing alone, is of interest as demonstrating the failure, in a particular instance, of purely private enterprise to prevent the growth of conditions inimical not only to personal well-being but to the economic standing of the city and to the continued effectiveness of the nation. Goldsmith's lines,

> Ill fares the land, to hastening ills a prey,
> Where wealth accumulates and men decay,

though written with particular reference to rural conditions, apply with full force to such urban centers as those of which Liverpool is a type.

Allowance must be made, in any review of this failure, for the difference between social conditions in 1864 and those of more than half a century later. Increased wages and a rising standard of working-class living would doubtless have lessened the earlier demand for dwellings in which lowness of rent was the chief consideration, but the persistently large proportion of low-priced accommodation in Liverpool stands out even yet as an appealing feature. Quoting from the 1916 report of the City's Housing Committee, there were in that year 152,477 dwelling houses, of which 135,317 (88 per cent.) were let at rentals not exceeding $127 per annum, and of these "113,127 were assessed at £13 and under." Adding to this last figure 15 per cent. as the probable difference between assessed annual value and rental, the rentals of these 113,127 dwelling houses (74 per cent. of the city's total) do not exceed $1.40 per week. It is significant that in the five years, 1912–1916, all the houses erected under a rental of $1.70 per week were provided by the city. That is to say, private enterprise had practically ceased to furnish working-class dwellings.

The experience of Liverpool in this respect is so well recognized as typical that housing reformers, bent upon remedying conditions during and since the war, have been compelled to turn their attention to the causes leading up to this increased dependence upon civic effort in a field once satisfactorily supplied by the enterprise of the speculative builder. Thus, in the presidential address of Mr. W. H. Bradwell, delivered before the Auctioneers' and Estate Agents' Institute, November 10, 1916, figures relating to seventy of the larger cities and towns (including London) were given. The population of the areas concerned is upwards of 13,000,000, representing 30 per cent. of the total population of the United Kingdom. In the five years, 1906–1910, 169,996 houses were built in these areas as compared with only 87,654 in the succeeding five years, these figures indicating a falling off of 48 per cent. during the second period.

The People's Budget

As regards the causes of this serious decrease in building, it is widely and authoritatively asserted that the Finance Act of 1909, often referred to as the Lloyd George Budget, is largely responsible in having frightened those who formerly made it their business to erect and sell houses. The new undeveloped land tax, designed to force the creation of buildings, not only failed to achieve that result but actually led to a loss of net revenue. Not only this, but instances of legalized hardship soon became known. Among these is the Lumsden case, in which a builder erected a house and sold it at a profit. He was charged "increment duty" on the transaction, although paying income tax on his trade profits in the regular course. In another case, 832 working-men bought small allotments to work as gardens and expended about $97,000 in fitting the land for that

purpose. Every one of them was assessed for "undeveloped land duty."

The conditions thus established, together with reasoned apprehensions for the future, were tersely summarized as follows, in July, 1918, in the report of an important housing conference convened by the Surveyors' Institution:

> Part I of the Finance Act has from the first exercised a prejudicial effect on housing, owing not only to the amount of the tax imposed upon the industry but also to the feeling of insecurity and alarm aroused by a measure which its supporters threatened to be merely the forerunner of still more advanced legislation. Whether there was good ground or not for these fears is entirely beside the mark, since the atmosphere of uncertainty was in fact created, causing investors and capitalists to fight shy of house property as an investment and influencing mortgagees to review their security and, in many instances, to revise their terms.

Some color is given these allegations of budget responsibility by figures taken from the annual reports of the inland revenue commissioners. These show that in the nine years immediately preceding (1900 to 1908, inclusive) there was an average annual increase in Great Britain of 85,722 houses of less than $97 annual value, while in the three following years this average fell to 59,332. As recently as December 28, 1919, Mr. J. A. Marriott, member of Parliament, stated that "the one real chance of getting houses was to restore confidence to private enterprise," and blamed the government for the present tendency of its housing legislation.

Governmental Action Since 1916

These considerations have much more than an academic or polemic value for those who may desire to avoid the pitfalls of legislation on false lines. English experience possesses in this respect a special value for a country whose laws are moulded on the precedents of the older nation and whose sentiments naturally flow along the same channels. It will be profitable, therefore, to review the confronting conditions and to trace the somewhat chequered history of the schemes devised during the last three years.

A statement issued by the Ministry of Reconstruction in 1918 placed the housing shortage in England and Wales alone at between 300,000 and 400,000, irrespective of any further deficiency which would accrue from the closing of slum property.* The census of 1911 showed that no less than one-tenth of the population was living under overcrowded conditions and a large number of the inhabited houses, both in town and country, were dilapidated or insanitary and in many cases also dark and damp. Many houses, in fact, "were not reasonably fit for human beings to dwell in." Of one city alone, it had been officially reported that "there are probably between 40,000 and 50,000 back-to-back houses, a large number of which are in courtyards, or in short terraces shut in behind houses which face the street." In regard to villages, one report had stated that "there is in many villages a clamant need for new and better dwellings and, after these have been erected, for the closure and demolition of many of the old ones. Certain villages have suffered evident demoralization as a result of the slow deterioration of the housing conditions of the people." A Royal Commission appointed in 1917 specifically drew attention to the fact of insufficient and bad housing being a cause of industrial unrest in seven out of the eight districts into which Great Britain was divided for separate investigation, and much further testimony of this character could be cited.

In addition to the number required in England and Wales, it was estimated by a Royal Commission in 1916 that 121,000

* This number, as stated by Lord Astor, Parliamentary Secretary to the Ministry of Health, January 8, 1920, has now been increased to 800,000 as the result of a review of the situation.

houses were needed in Scotland to remove overcrowding, apart from any provision to meet the natural increase, and it may be conservatively stated that the present need of working-class houses in Great Britain (i. e., exclusive of Ireland) is little short of a million dwellings, taking Lord Astor's statement into account.

Ireland is a distinct and, in some respects, less onerous future problem. It is true that Dublin, the capital city, offers a task at least as difficult as any to be found in the United Kingdom, for "16,500 new houses are urgently required and 13,000 existing dwellings call for radical and immediate improvement" at an estimated expenditure of $42,000,000. On the other hand, the needs of rural districts are being met by special legislation, under which nearly 50,000 laborers' cottages have already been provided from public funds. Since November, 1906, loans for this purpose have been advanced to Irish local authorities at 3¼ per cent. per annum, this covering interest and repayment of principal for a term of sixty-eight and one-half years. The state bears 36 per cent. of this charge, leaving 64 per cent. to be borne by the local authority as the ultimate owner. These substantially built four-room cottages, some with half an acre, the remainder with an acre of land attached, are let at an average rental of 30 cents per week — about one-third of the economic rent — the tenant paying, in addition, 6 to 8 cents per week for "rates" (local taxes). Up to November 30, 1915, loans amounting to $43,382,000 had been sanctioned.

British Taxation Methods

A full realization of the ascertained conditions led the Local Government Board for England and Wales to decide, in July, 1917, that substantial financial assistance should be given from national sources to local authorities prepared to carry through without delay, at the conclusion of the war, working-class housing programs duly approved by the board. In order to make the financial proposals intelligible to American readers, it is necessary to set forth some fundamental distinctions between American and British methods of assessment and collection of local levies, known as "rates" to distinguish them from national "taxes." In America, the assessment is upon the nearest possible approximation to the fee simple — practically the amount for which the affected property would sell in the market — and all tax burdens are borne directly by the owner, whose obligation is not affected by the premises being occupied or vacant. In Great Britain, the assessment is upon the "rateable value," which for present purposes may be taken as 85 per cent. of the annual rental. As these local rates are borne by the tenant, it will be seen that nothing is collectable from vacant premises. An exception to this is found in houses of low rental, for which, whether continuously occupied or not, the owner pays the rates, subject to a rebate in consideration of his so doing, the object being to avoid the trouble and uncertainty of collecting from a floating population. It should be noted, in passing, that there is a growing sentiment against a system which, whatever its convenience, detracts from the sense of personal interest and responsibility inherent in the general British practice, by depriving the tenant of any tangible financial concern in the administration of the area in which he lives. While the effect of the "compounding" system is as I have stated, it is equally true that the evil is not capable of easy remedy under the conditions applying to this class of property.

It will now be understood that, instead of applying the American unit of so much per thousand dollars of value, an Englishman speaks of local assessments in terms of "a penny in the pound" (0.417 per cent.) of annual realized value. Computations based

by the writer upon the average rates for 1905–1906, in England and Wales and Massachusetts respectively, showed that each additional penny levied under the English system would raise the Massachusetts tax rate by 26 cents. That is to say, the 1905–1906 average rate of $17.25 per thousand would become $17.51.

The Program of 1917–1918

With these data in mind, it will be less difficult to appreciate the terms of the English government's initial and subsequent proposals. These were foreshadowed in a circular addressed to the local governing bodies of England and Wales on July 28, 1917 by Mr. Hayes Fisher, then president of the Local Government Board. In a further circular, dated March 18, 1918, the principles on which government aid for housing would be afforded were set forth at length. These placed the initial financial burden, in its entirety, upon the local authorities, the government's contribution taking the form of a guarantee applying to a certain percentage of the ascertained annual loss. To that end, the local authority would raise a loan in the customary manner, the eventual sanction of such loan following the usual local inquiry by an official of the Local Government Board. The loan was designed to cover an initial emergency period of not less than seven years,* the necessary state assistance being given not as a subsidy toward the expenditure, but "in the form of a grant of a percentage of the loan charges sufficient to relieve the authority of 75 per cent. of the established annual deficit." That is to say, the prospective inability to collect an economic rent was clearly recognized and the contemplated action of the state left only 25 per cent. of the resulting deficit to be borne by the local authority.

It should be noted that houses built by private enterprise during the prospective emergency period would face the added competition of the subsidized schemes. A concession was made in favor of public utility societies whose profits were restricted to 5 per cent., by including them in the same category as local authorities as regards the state's 75 per cent. contribution.

The adoption of seven years as the initial "emergency period" was intended to allow sufficient time for prices and economic conditions generally to become stabilized after the war. At the end of the period, 75 per cent. of the excess (if any) of the amount of the loans outstanding over the then ascertained value of the property would be assumed by the state. In the case of loans directly financed by the state, this could be done by writing off the necessary portion of the outstanding liability; in other cases the state would undertake the appropriate share of responsibility for future charges.

Under the 75 per cent. provision it was originally intended that the state's contribution toward the annual deficit should be three times the amount of the call upon local revenues, but later concessions to local representations increased the state's obligation. It was estimated in a concrete case, under the original terms, that a local burden of 5 pence (say 10 cents) in the pound ($4.87) would have to be borne by the rural district concerned and that even a government contribution at the rate of 90 per cent. would leave the district saddled with a housing rate of 2 pence in the pound, although there was a discretionary limitation of the burden to the proceeds of a penny rate levied upon the chargeable area. Applying the figures of this rural district case to the comparison already made between British and Massachusetts local taxation levies, this would involve a total additional

* The *entire* loan period would vary from eighty years for land purchase to sixty years for substantial buildings. For streets and sewers the usual periods are twenty and thirty years respectively.

tax of $1.08 upon each $1000 of the normal Massachusetts assessment.

Some Disturbing Factors

What can best be described as "the fly in the ointment" is found in the conditions imposed upon local authorities in regard to structural provisions. The terms of government assistance contemplated what many regard as the extravagant requirement of single self-contained houses, not exceeding twelve per acre in urban and eight in agricultural districts, and the model plans and regulations called for a much greater outlay per dwelling than had ever previously been regarded as necessary or desirable. These conditions are probably responsible, in the main, for the discouraging response of local authorities to date. So far from having secured the building of the first 100,000 houses within a year from the adoption of the scheme, there has been a distinct reluctance among local authorities to avail themselves of its provisions. Official figures, referring to construction bids examined and approved at the Ministry of Health, show that up to October 31, 1919, a total of 7,121 proposed houses had thus been dealt with. The average amount of these bids was $3,497 per dwelling, and even this did not include land, roads and sewers.*

It is obvious that such figures are wholly incompatible with the ideal of economic rent.† As concrete examples of these conditions, the writer may cite two representative cases coming under his notice last summer. In one of these the financial estimate for 10,000 houses, planned for one of the largest provincial cities, was based upon an excess of 50 per cent. over pre-war building costs, with collectable rentals of 100 per cent. over pre-war rates. Notwithstanding these favorable assumptions, it was computed that the state, apart from the local authority, would be called upon for an annual subvention of $1,070,000 during the initial seven-year term. This represents an annual contribution, from national funds alone, of $107 per house per annum and takes no account of the capital sum required for the "writing down" process. In the other case it was officially estimated that 800 houses, costing $4,383 each, would entail an annual financing charge of $411.53 per house, as against an available rental of $158.28, leaving $243.25 as the annual loss per house to be met from public funds, local and national. In other words, the collectable rental would amount to less than 40 per cent. of the annual charges.

The Housing Act of 1919

Considerations of this kind doubtless led to the inception of the new housing bill introduced by Dr. Addison, President of the Ministry of Health, in December, 1919. This department, created by an act of June 3, 1919, takes the place of the Local Government Board for England and Wales and exercises wider functions than those of the earlier body. Its title is significant of the increased importance attached to health problems, as distinguished from poor-law administration and similar needs, and nothing more clearly shows the advance in public opinion, during the last half century, than the unanimity with which these enlarged powers have been recognized as essential.

Chief among the provisions of the new housing act is the power conferred upon the department to make grants to persons or bodies building houses for the working

* It was announced by the Director General of National Housing, speaking in London on January 8, 1920, that 20,000 houses were actually in course of construction.

† There has been for some time a stronger governmental tendency toward the attainment of this ideal after the emergency period. Dr. Addison, Minister of Health, stated on January 9, 1920, that local authorities had been recommended to charge an economic rent for their houses, after writing off one-third of the cost as extra cost due to the war.

classes, to an aggregate amount not exceeding $73,000,000. This is based upon the payment of a subsidy of $730 per house completed within fifteen months after the passing of the act, which also contemplates the issue, by local authorities, of bonds for financing building schemes. There are, in addition, far-reaching provisions in regard to the closing of slums, and other local powers. The aim of the local financial clauses is to relieve the state, in a critical period, from pressure in the raising of funds while leaving the government's control over construction and administration intact. Among other noteworthy features in this respect, funds can be made available for converting houses into flats, and building operations which interfere with the provision of dwelling houses can be prohibited. The tendency toward a relaxation of needlessly drastic local ordinances — a point to which much attention had been given for some years before the war—is exemplified in the exemption from their operation of houses complying with the conditions laid down in the act itself.

Awaiting spring for its fruition, it seems unnecessary to indulge in speculations as to the results to be expected from an act based upon much tentative work and which has given rise to recrimination unusual in English political life. The operation of the new proposals will be of interest to many beyond the limits of the United Kingdom, not only on account of the magnitude of a task too long delayed and the exceptional financial methods entailed, but also because of the apparent desire to embark upon experiments in types and materials. Even wooden houses are seriously proposed, and the mounting cost of construction, revealed to some extent by figures quoted in the present contribution, may be expected to facilitate inroads upon methods sometimes regarded as akin to the legislative products of the Medes and the Persians.

SUPPLEMENTARY NOTE

Developments during the last three months confirm the tendency toward excessive cost of building and the difficulty of reconciling this factor with the desired approach to an economic rent. Contract amounts for building alone frequently range from $4500 to $5000 per dwelling, to which must be added the cost of land, sewers, lay-out, etc. There are many indications of dissatisfaction with the share attributed to labor union restrictions in this result. The bonus scheme mentioned in the present article was not favorably received, the governmental subsidy of $730 per dwelling erected by private builders being regarded as inadequate — a feeling which appears to have been justified, judging from the increase to $1200 announced by the Ministry of Health on May 12, 1920. The scheme of local bond issues for financing housing operations has been vigorously pushed in some localities, three cities announcing an aggregate of $5,500,000 thus raised. In another city, weekly payments toward the purchase of these bonds are being received from workpeople by employers and works committees, and still other cities have inaugurated school savings associations to the same end.

An apparently reactionary outcome of the desire for economy is disclosed in a recent decision of the Ministry of Health, refusing sanction to loans for houses to be erected under the "twelve per acre" rule, in which the ceilings of habitable rooms exceed 8 feet in height. It is being urged by local authorities that this attitude imposes difficulties upon them in enforcing their own by-laws calling for a height of 8 feet 6 inches, but the Ministry has thus far shown no signs of yielding. On the other hand, a bone of contention has been removed by the abandonment of the Lloyd George Budget land taxes referred to in this article. The step thus taken in this year's budget appears to have been as unexpected as it is welcome to land and building interests.

Notwithstanding these and other obstacles, the latest official returns show that schemes for 184,173 houses have been approved by the Ministry of Health, which reports also that actual building has started on 13,355 houses. The Ministry has had to bring pressure to bear, in some cases, upon local authorities lagging behind in the prosecution of this necessary work. The ultimate high cost per dwelling and the difficulty of securing labor and materials are the causes assigned, but progress is being made and the prospects for next year's operations may be regarded as satisfactory. — *J. S. H. June 12, 1920.*

PHTHISIS AND OCCUPATION*

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FOR more than two centuries it has been known that certain trades are attended by a higher mortality from lung diseases than others, and in general terms the higher mortality occurs in those industries in which large quantities of dust are generated. Before British coal mines were ventilated by the two-shaft system in use today, viz., a down and an up-draught shaft, whereby healthy atmospheric air is carried into the mine, is driven and directed through it by fans and doors, and the foul air forced to escape by the up-shaft, coal mining was a deleterious occupation; it was attended by a high incidence of pulmonary disease, which in our day has undergone considerable diminution. In the Infirmary we seldom meet with cases of pulmonary anthracosis as was frequently the case forty years ago. This happy condition of things is largely the result of the introduction into the mines of fresh atmospheric air.

Nor do we today find stone-masons' phthisis as prevalent as it used to be. Three decades ago, phthisis was extremely prevalent among the lead miners in the remote dales of the County of Durham; but this was largely the consequence of neglected colds caught by the men coming out of the mine, heated and tired after a long day's work and then being obliged, owing to the scarcity of houses, to walk several miles home across cold wind-swept moors; it was, too, the result of the housing of men in barracks close to the mine. These barracks were overcrowded during five days in the week, the sleeping rooms were practically always occupied by relays of men and were never ventilated, the beds were so close to each other that there was scarcely room to walk between them, and sufferers from bronchial and pulmonary affections expectorated upon the floor. Among these men, pulmonary tuberculosis was less the result of occupation than a consequence of infection and of neglected pulmonary catarrh. Similarly, in the manufacture of pottery, owing to absence of down-draught for the removal during brushing-off of the flint dust in which the ware had been fired, potters suffered in large numbers from a malady of the lungs known as "potters' rot," but here again, since the introduction of means for the removal of the dust, ware cleaning has ceased to be the dangerous occupation it formerly was. File cutters in Sheffield formerly showed a high death rate from phthisis. This was not entirely the result of dust but was due in a measure to the close and ill-ventilated state of the rooms in which the work was carried on, and to the possibility of infection. Steel grinders too suffered in large numbers from the disease, known in this case as steel grinders' phthisis.

The discovery of the tubercle bacillus has been utilized to indicate that there is a unity underlying pulmonary consumption, and that it is the part played by this organism which determines both the nature of the malady and the longevity of the patient. Small wonder, therefore, if the tubercle bacillus is regarded as the specific and causative agent, that doubt should be raised as to occupation being a cause of phthisis among workmen. There is a feel-

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ing among some physicians that occupation cannot give rise to such a specific disease as pulmonary consumption and that when consumption appears in workpeople it is because occupation has simply activated tuberculous lesions which have been lying latent since childhood. On the other hand, it is common knowledge that since the introduction of better ventilation into factories the mortality rates from pulmonary tuberculosis have considerably diminished. Other factors may possibly have been in operation, such as better housing and reduced drinking of alcohol. The question, therefore, arises: Is pulmonary phthisis in its earliest inception always tuberculous? Is dust of no importance, or alternating exposure to heat and cold, and does injury to the chest wall never play a part in leading to tuberculosis? What is to be said too of those occupations which oblige the worker to remain in a cramped position whereby the respiratory movements of the chest become limited, thus interfering with respiration and reducing the local resistance to disease?

Clinical experience and statistics alike show that there are cases of pulmonary consumption which are due to occupation and are a consequence of direct injury to the lungs by inhalation of dust — inorganic and organic — the course of which may run from commencement to finish without the tubercle bacillus playing any appreciable part in the illness, or if present the bacillus is grafted upon pulmonary tissue already diseased and thus contributes to a more rapid ending of the illness. Pneumoconioses or dust diseases of the lungs are, therefore, both non-tuberculous and tuberculous, and if I were to choose a good example of such a malady it would be that of gold miners' phthisis. We must remember that so widely spread is tuberculosis that evidence of it in some degree is present in 70–80 per cent. of the bodies of patients dying in infirmaries from all causes. It requires little to light up a latent tuberculous lesion. Herein lies the necessity of care being taken to remove all possibility of dust irritating the lung and of the careless neglect of common colds. The presence in a workroom or factory of a tuberculous workman who expectorates anywhere is a danger to others. I do not say such a workman should be removed but spittoons should be provided containing antiseptics. In the same way dry sweeping of floors is dangerous. Floors should be previously wetted and should be swept when the people are out of the factory. This same remark applies to schools. The type of factory too has something to do with tuberculosis — those are the worst which are dark, damp and ill ventilated. So, too, home conditions play a part. I think I can give you a good illustration of this. When Captain Evans, the Antarctic explorer, was staying with me a few weeks ago, I discussed with him hygienic questions, one of which was the high mortality from tuberculosis among the fisher folk on the Norwegian coast. In this connection, Captain Evans obtained for me from Dr. Andvord of Christiania the following statistics for the years 1912–1914. These numbers are the mortality returns of tuberculosis per thousand inhabitants: In the center of Norway, 1–1.5 per thousand; in Stavanger and Bergen center, 2 per thousand; in the district immediately north of Bergen, 2–5 per thousand; in the district still further north of Bergen, 2–3 per thousand; and from there up to Tromsoe, the narrow part of the peninsula, 3–4.5 per thousand. In Newcastle, the tuberculosis death rate is 1.37 per thousand, so that in the northern half of Norway the deaths from pulmonary tuberculosis are three to three and one-half times greater than they are in Newcastle, and yet these people are living on the coast or close to it and are following a healthy but hazardous occupation. Clearly, occupation is not the cause of the high mortality rate

from phthisis in Norway, but overcrowding in dark and ill-ventilated houses, and poor food. That such factors are contributory is shown also by the rise of the tuberculosis mortality rate in young women workers in Newcastle during the war.

Dusty occupations play a part in causing pulmonary phthisis. Some dusty trades will show 54 per cent. of deaths from respiratory diseases, whereas among people living in the same district, but not occupied in dusty trades, there may be only 22 per cent. of deaths from these maladies. To such an extent may dust cause death, that of steel grinders in Sheffield in 1889–1910, 43 per cent. died from tuberculosis, and at the copper works in Montana, U. S. A., out of 1614 deaths during 1907 and 1914, 37.9 per cent. occurred in miners and were due to pulmonary tuberculosis; whereas among the non-mining class only 10.8 per cent. died from this disease. These facts certainly point to dusty occupations creating a soil favorable to the development of tuberculosis.

The shortness of time at my disposal will only allow me to draw your attention to one or two points in the pathology of the disease which may not be without interest to some of you. There are some physicians who hold that fine coal dust, since it is composed mostly of carbon, is not destructive, but may be really helpful to the lung in consequence of the small amount of calcium present in the dust. But coal dust varies: some contains a good deal of stony material and, while the carbon particles from their softness may do little or no harm to the lung, the same cannot always be said of the hard particles of stone which may be present.

One of the greatest risks coal miners are exposed to is the occurrence of explosions. These are not always due to gas but frequently to the firing of the fine particles of coal dust which are raised into the atmosphere by the draught of air whisking through the mine. How to lay the coal dust and render it harmless has been one of the problems which mine managers have been trying to solve for years. Spraying the walls and ledges of roadways by means of colloidal calcium, as Belger who worked in my laboratory suggested, has been tried and found to be effective. Another method to which Sir William E. Garforth gives the weight of his support is to powder the dusty surfaces with finely crushed shale, so that, if dust is raised into the atmosphere, the particles of shale interpenetrate with those of the coal, with the result that an uninflammable mixture is formed. We are not, however, at present discussing the prevention of explosions in coal mines. The point we have to consider is, whether, if finely pulverized stone dust is introduced into coal mines, some deleterious material may not be drawn into the lungs of the miners when at work and harm follow.

Northumberland coal is harder than that of the County of Durham: it contains a fairly large quantity of silica so that miners when winning coal must, during the active period of their lives, inhale a considerable amount of stony material, and yet it cannot be said that the mortality of Northumberland coal miners from pulmonary tuberculosis is unusually high. A similar remark applies to the Nottingham and Derby coal miners. In these counties the coal seams are fairly rich in crystalline silica and yet the death rate from lung diseases, up to the age of fifty-five years, is not only far below the average of men following other occupations, but is even slightly lower than that of the farm laborer. To Dr. John Haldane of Oxford we are indebted for new views upon this subject. It is generally admitted that all dust, unless it is soluble and chemically harmless, will, if inhaled, injure the delicate structure of the lung. Some kinds of dust, such as pure silica, may cause permanent injury to the lungs, whereas coal dust, notably coal and shale dust, may cause no

cumulative injury unless inhaled in large quantity. In Dr. Haldane's experiments various kinds of pulverized material were made use of, and dust was always found in the lungs after a lengthened period of exposure. Dr. Haldane also found if several weeks were allowed to transpire after inhalation of a dusty atmosphere that particles of coal and shale had considerably disappeared from the lungs, that the respiratory organs were gradually becoming clear again, whereas in the case of animals, exposed to an atmosphere impregnated with dust taken from the South African gold mines, there was no disappearance of the stony particles from the lungs. In these animals if still a few months longer were allowed to elapse, while the coal and shale dust might have entirely disappeared, the flint and quartzite particles from the Transvaal mines were just as abundant as immediately after the cessation of exposure to the dust. In my own experiments I was struck by the rapidity with which inhaled coal dust is removed by the large cells which become detached from the pulmonary alveolar wall — phagocytes which pick up the dust and are expectorated or make their way into the pulmonary lymphatics and deposit their burden in the glands at the root of the lung. Towards flint and quartzite particles there is not the same response on the part of the phagocytes and therefore the dust particles remain pretty much where they were. A coal miner's lung, if it is free from recurrent bronchial catarrh and is not too strongly impregnated with dust, can be fairly rapidly cleared of dust, whereas in the case of the gold miner and the Sheffield steel grinder and workers in some other dusty trades, the particles of inorganic material remain in the lung.

Since it appears, therefore, that the lung behaves differently towards different kinds of dust, we naturally ask ourselves why this should be so. Why do coal and shale particles disappear from the lungs of miners, while those of flint and quartzite are not removed, for in shale dust there is present a small quantity of quartz and the particles of dust are just as hard and angular as those obtained from the rock of South African gold mines ? So far as injury inflicted upon the lung is concerned, it does not appear that the injury is caused by the crude chemical composition of the dust. It depends in all probability upon the power which certain kinds of dust possess of absorbing other substances. In my address to the Congress of Hygiene and Demography in Washington, U. S. A., in 1912 I showed, as the result of experiments carried on over a period of many months, that coal dust and pieces of coal varied in weight from day to day, and that this was due to the power coal possessed of absorbing gas from the atmosphere: in a word, coal absorbs and evolves gas just as in ordinary respiration. It was quite different in my experiments with stone dust; with this there were no such interesting rises and falls of weight as with coal dust. Haldane has gone further and has suggested that insoluble dust particles are attractive and stimulating to the large pulmonary phagocytic cells in proportion to the soluble substances which the dust particles have themselves absorbed; that dust particles which have not absorbed such soluble substances or have done so only to a limited extent will be correspondingly unstimulating. Mavrogordato continued the experiments on Haldane's lines and allowed animals to breathe an atmosphere containing in suspension both coal and flint dust, with the result that when in due course he examined the lungs of animals which had inhaled the combined dust, the whole of the flint particles had practically been removed.

It appears, therefore, that since experience and experiment alike show that the inhalation of coal and shale dust when breathed in moderate quantities is not followed by permanent injury to the lungs,

since this kind of dust stimulates phagocytic activity, and since it appears that flint and quartzite particles which have reached the lung are also removed, there can be, therefore, little pulmonary risk incurred by coal miners when, in order to prevent explosions in coal mines, stone dust is sprayed upon the fine carbonaceous dust which is so frequently present in certain mines.

BOOK REVIEWS

Safety Fundamentals. Lectures Given by the Safety Institute of America. Cloth. Pp. 228 with illustrations, bibliography, and index. New York: Safety Institute of America, 1920.

This book is a collection of the ten lectures which comprised the series given under the auspices of the Safety Institute of America, February to June, 1919, to assist inspectors employed by the city of New York and the states of New York and New Jersey, and by insurance companies in and near New York City, to enlarge their knowledge and broaden their experience. The information contained in these lectures is intended not so much to aid inspectors in recognizing and eliminating the obvious hazards for which guards may easily be designed and applied, as to interest them in those subtle factors that are seldom appreciated and understood in safety work, but which are so largely the forerunners of accidents and which are intimately related to the worker's person and conduct.

The book may be divided into three parts. The first, which is composed of the first four lectures, treats subjects directly connected with the worker's person under the following headings: *The Body Which Gets Hurt; The Injured Body and Its Treatment; Protective Clothing for Men and Suitable Work Garments for Women;* and *Safe Heads and Good Eyes.* The second part includes the subsequent four lectures which cover specific matters closely associated with factory construction, i. e., questions of the guarding and the arrangement of machinery, heating, ventilation, and illumination. In the last part, comprising the ninth and tenth lectures of the series, the discussion is of a general nature. In his lecture on *Nature's Forces For and Against Workmen,* Mr. Rausch includes various hazards encountered, such as, hazards in methods of combating fire, smoke, and chemical hazards, hazards due to static electricity, explosive liquids and compounds, the wind, compressed air, dust, water, etc. The final lecture, *Safety Education and Shop Organization,* contains a discussion of the fundamental principles of safety and its by-products, and emphasizes the necessity of securing the hearty co-operation of the management, the foremen, and the men in the shop.

The extensive bibliography, which is appended to the lectures, is divided into ten parts, each containing suggested supplementary readings for each corresponding lecture. All the publications included are to be found in the Safety Institute's free reference library, where they may be consulted by anyone interested in safety work. — *R. M. Thomson.*

Sanitation for Public Health Nurses. By Hibbert Winslow Hill, M.B., M.D., D.P.H., Late Director, Division of Epidemiology, Minnesota State Board of Health, and later Director, Institute of Public Health; M.O.H., of London, Canada; and Professor of Public Health, Western University; now Executive Secretary, Minnesota Public Health Association; Author of "The New Public Health." Cloth. Pp. 211 with index. New York: The Macmillan Company, 1919.

This book was written for the purpose of giving to public health nurses a concise view of the fundamental requirements of public health nursing as it is today. Emphasis is placed especially on such aspects of the problem as may be included under sanitation, that is, sanitation as applied to disease prevention.

The author describes and discusses in non-scientific language the following common infectious diseases: typhoid, paratyphoid, typhus, scarlet fever, Dukes' measles and German measles, smallpox, chicken pox, diphtheria, tonsillitis, septic sore throat, Vincent's angina, whooping cough, mumps, colds, poliomyelitis and cerebro-spinal meningitis, syphilis and gonorrhea, tuberculosis, and leprosy. Immunity and anaphylaxis are defined and their attainment described. The theory and practice of epidemiology are considered chiefly in their application to the study of the transmission of disease from living body to living body, with a desire to interfere with that transmission. The fact that only a brief discussion of such questions as ventilation, food, water, milk, flies and parasites is included, is perhaps best explained by the following quotation from the author: "To advocate 'cleanliness' for the prevention of disease is to deceive with a false sense of safety those who, properly enlightened, might take the only real precautions that are effective." — *Maude Barton.*